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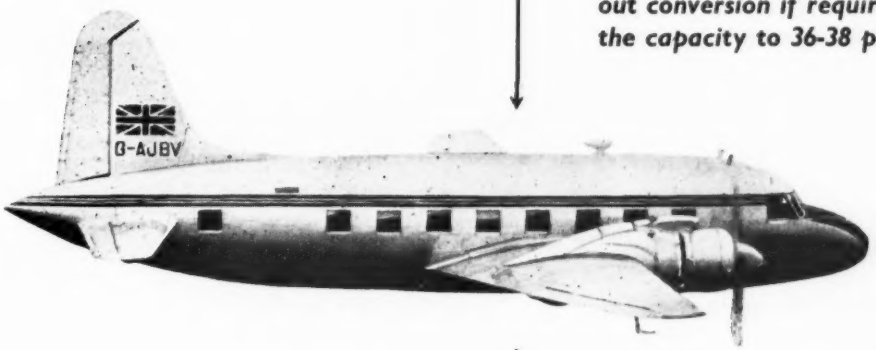

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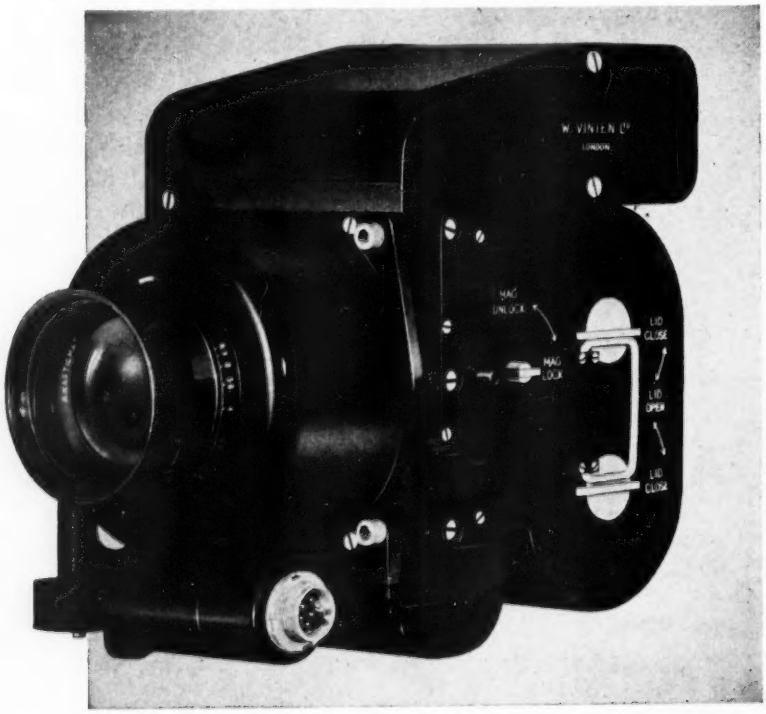

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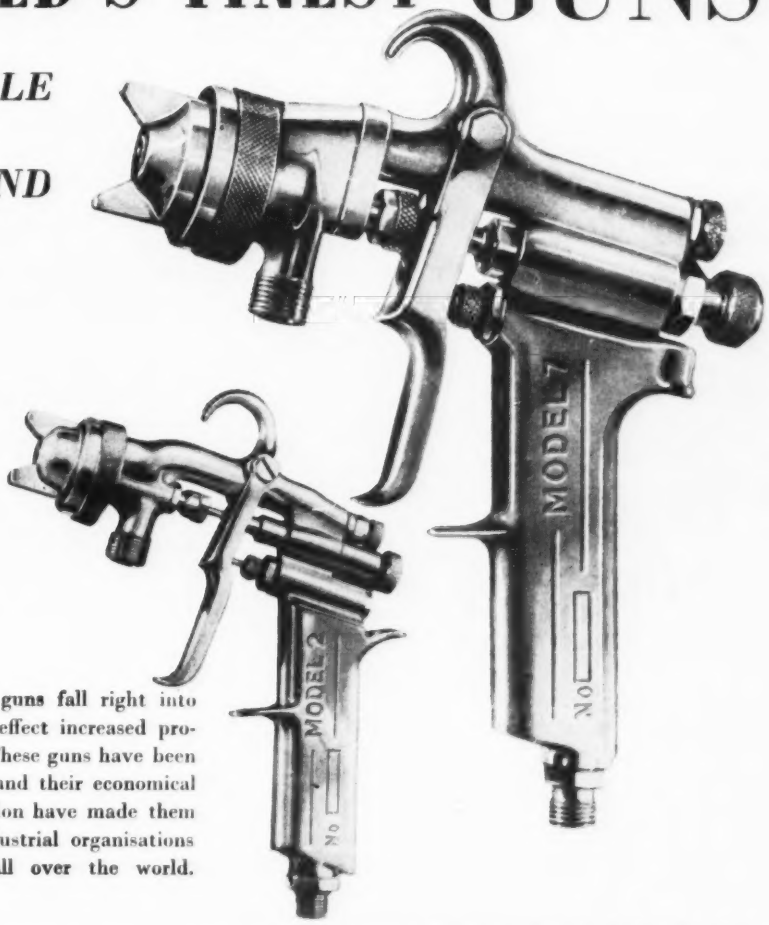

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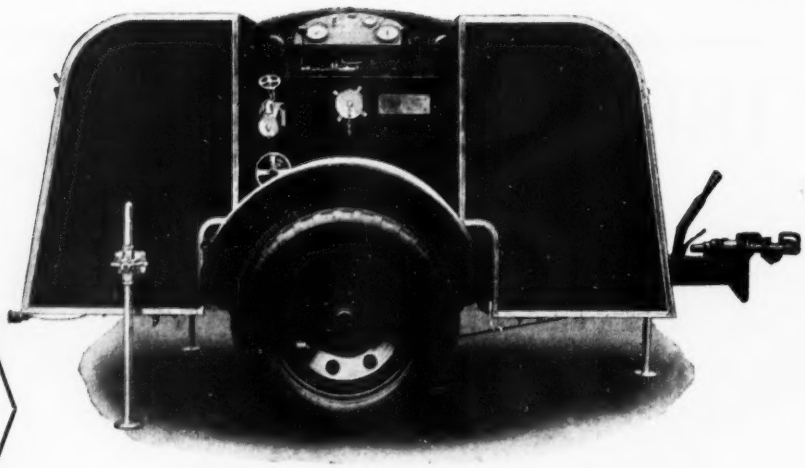

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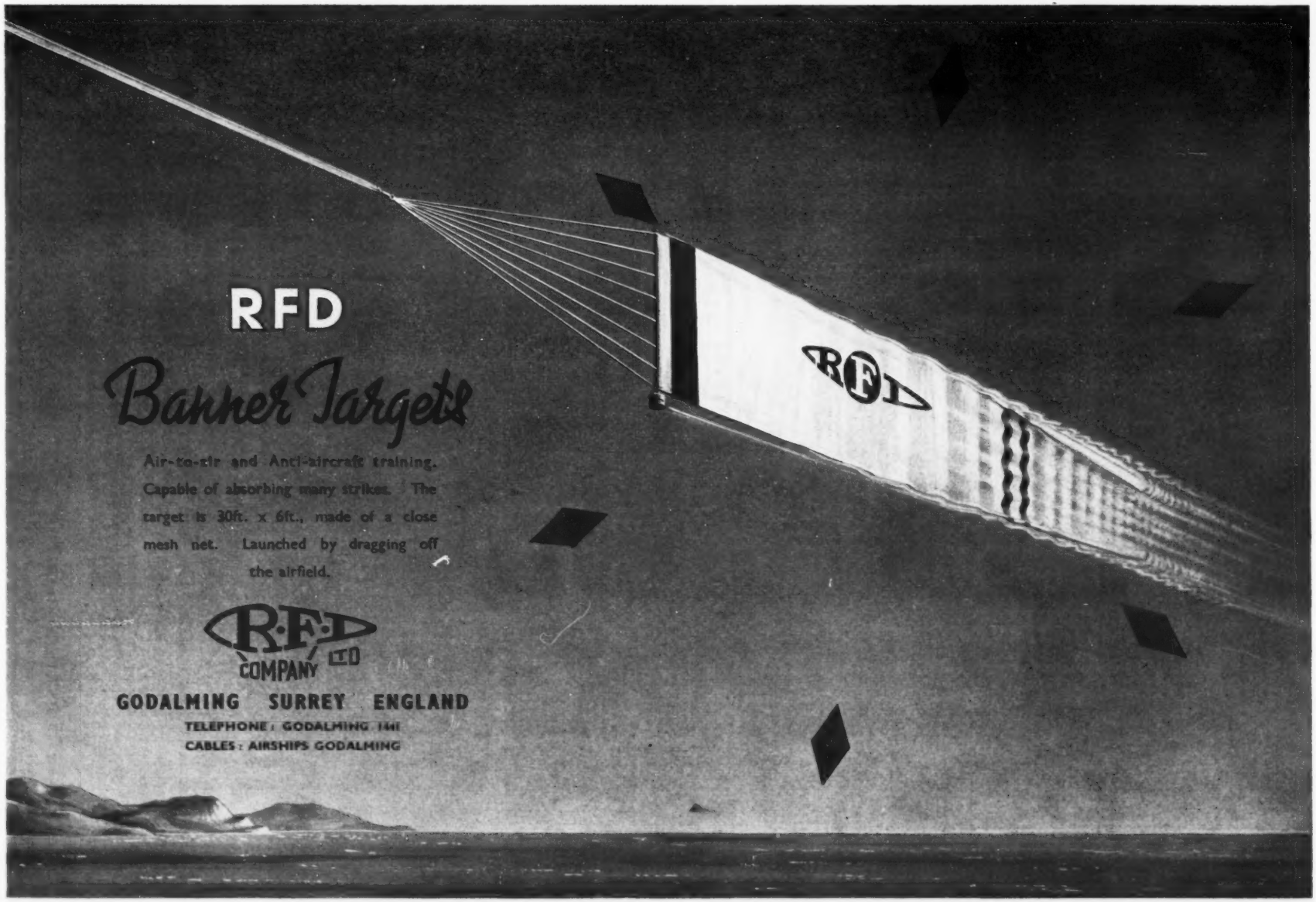
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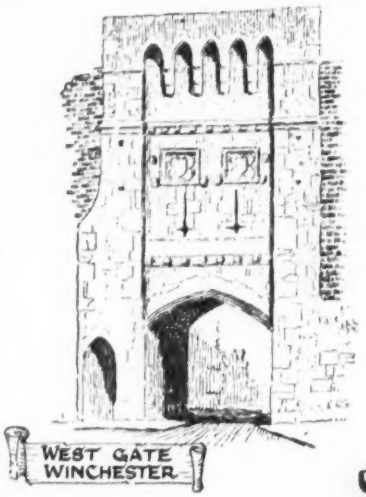

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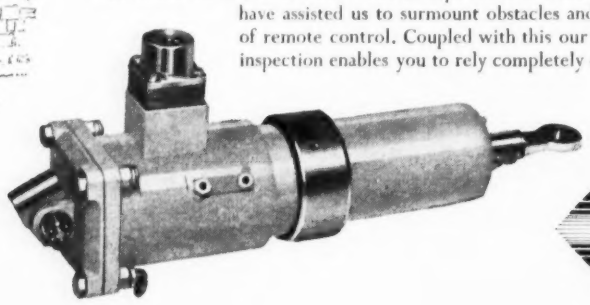

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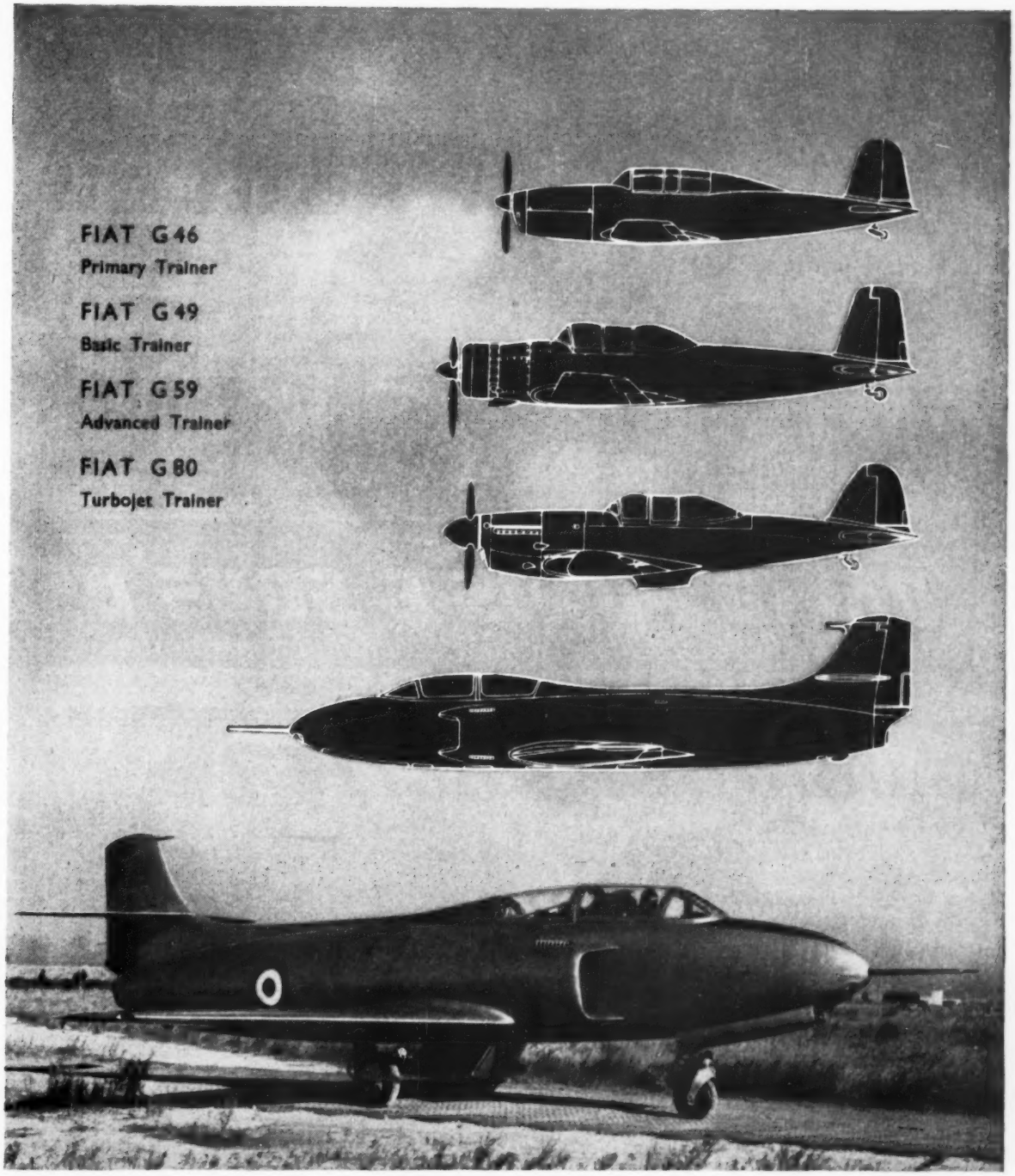

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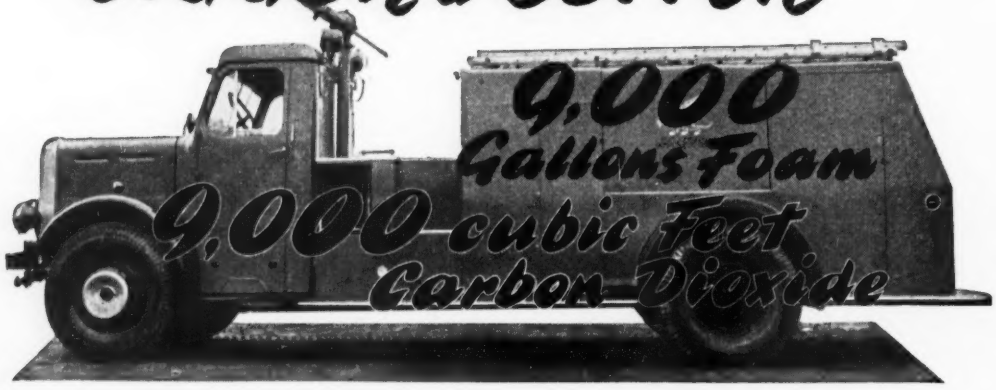

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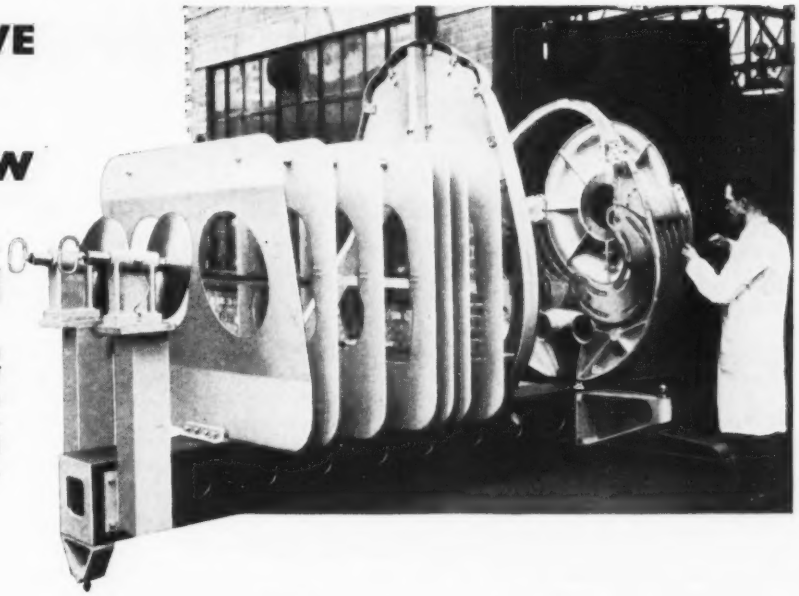

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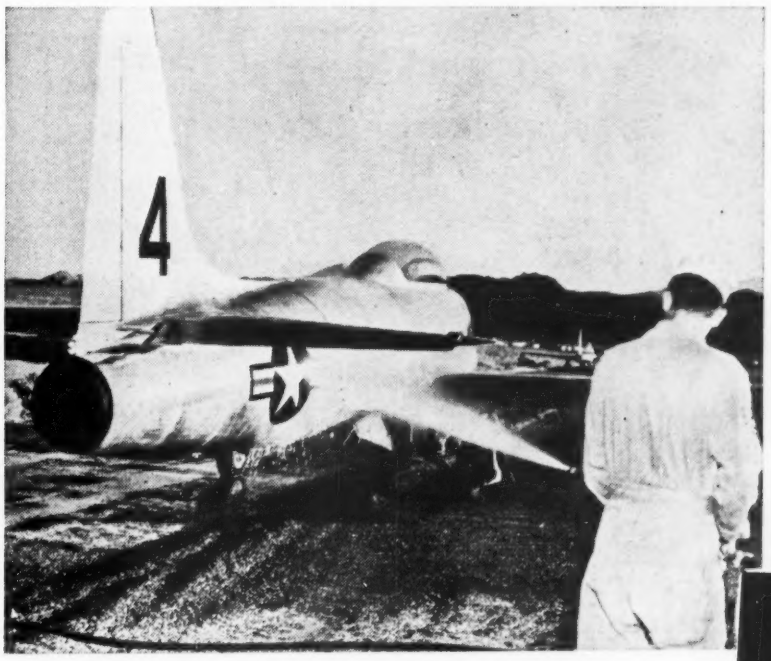

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QUEEN MARY

FOR her queenly dignity, her human understanding, her fortitude in times of personal and national stress, the peoples of the Commonwealth remember Her Majesty Queen Mary with reverence and love. While nurturing tradition she was not intolerant of the present. Mr. Churchill has reminded us that, when she was born, electric light and the internal combustion engine were unknown; yet "she lived into this atomic age, moving easily through the changing scenes." The people who revered and loved her, sorrow deeply.

Opportunities for Technicians

ARE technicians in the British aircraft industry afforded proper opportunities for advancement, and are their services adequately rewarded? For many weeks past *Flight* has been affording space for a cross-section of those employed on aircraft design and manufacture to express their views on these important questions. Contributors have included representatives of design and stress offices, executives, technical directors, and several technicians of British birth who have sought to improve their fortunes by quitting these shores for the milk and honey held out by the North American continent. Clear-cut conclusions and recommendations do not suggest themselves, but with this material as a basis one or two generalizations can be attempted.

First of all, then, it may be stated that a really first-class technical man will find ready employment not only with any aircraft company but also in any country; moreover, if we judge by actual examples—details of which have been given to us in confidence—such men move rapidly up to remunerative positions of importance and responsibility, practically regardless of age. Lord Hives said this in as many words in an address at Nottingham University, *Flight's* summary of which led to many of the letters and articles with which we are here concerned.

But not many of us manage to achieve and maintain exceptional or above-average standard, and thus the bulk of the routine work is done by average men and women. Here both the managements and the individuals can—and should, it seems—make improvements. Briefly, post-graduate training and broader experience are called for, and heads of departments should not only permit but should actively encourage members of their staffs (and, it follows, their companies) to benefit from any special lectures, courses, and opportunities that are open to them. For their part, the individuals should avail themselves of the facilities and make the personal effor tinvolved. It is not easy to keep up-to-date and conversant with the other man's work, but to do so is a great advantage.

Considering further the case of the average men—who represent, of course, the great majority—it is very difficult to estimate how much as a whole they would benefit from post-graduate instruction, or, having benefited, what increase in pay they could reasonably expect as a result. If increased knowledge were automatically to bring better pay, then an important incentive would be created and more than one problem would be solved. The salary problem might not then call for any further discussion. At present the majority of technicians, draughtsmen and others doing comparable work in the aircraft industry are relatively poorly paid, and the maximum salaries that can be foreseen offers no great attraction to well-qualified youngsters. In addition, promotion comes the way of but few, and the status of the job is, for some unknown reason, less highly rewarded than in other countries. It is true that the man who is inefficient is unlikely to fare any better abroad than here; on the other hand, there is little doubt that many technicians' complaints of aircraft-industry over-specialization and dead-end work are made with some justification.

We may conclude by stating that were it not that the very future of this nation was becoming increasingly dependent upon its aircraft manufacturing and operating industries, the maintenance of strong and stable organizations which will attract new brains in plenty might not be of such general and serious concern. As the Parliamentary Secretary to the Ministry of Education said recently at Cranfield, if the nation cannot continue in greatness, it cannot continue in comfort.

CANBERRA ELEVEN MILES UP

UNOFFICIAL though it is, the altitude record of the Olympus Canberra test-bed, set up on March 24th, is remarkable for several reasons. It is the first occasion on which a conventional aircraft, other than rocket-powered research machines, has exceeded 60,000ft. The flight was made during routine high-altitude development flights for the Olympus turbojets. Again, there were no special arrangements or preparations; on the contrary, the airframe is of standard type and carried all its special instrumentation together with the pilot, Mr. Walter F. Gibb, Bristol's assistant chief test pilot, and Mr. F. M. Piper as flight observer. It is understood, incidentally, that successful re-lights have been achieved at very high altitudes.

Although the official power rating of the Bristol Olympus has been given as 9,750 lb static thrust, it was revealed at the time of the Farnborough Show, when the Olympus-Canberra was first demonstrated, that the thrust of each Olympus in this installation was reduced to some 8,000 lb. This is because the standard wing-spar holes through which the jet pipes must pass were designed with the thrust of the smaller Avons in mind, and the cross-sectional area of the Olympus tailpipe is thus restricted.

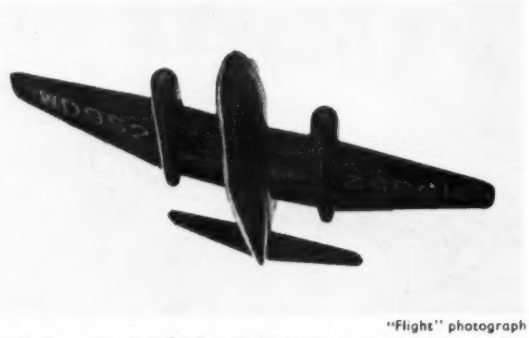
It is most probable that an official attempt on the height record will be made during the early summer. If so, the aircraft will no doubt be lightened and specially prepared. Even so, at such an extreme altitude it will be no easy matter to exceed John Cunningham's existing record of 59,446ft—set up in March five years ago—by the requisite 4 per cent. It will be recalled that on Cunningham's special Ghost-Vampire a pound of weight saved was calculated to be worth 2ft in height at the top.

The Canberra's climb curve is bound to be almost flat at 61,000ft, and there can be little speed margin between stall and critical Mach number—20 kt at the most. It is for this reason that great piloting skill will be needed. The last thousand feet will probably take longer to attain than the first 10,000.

Modern high-speed aircraft often give little stall warning. An absence of early buffeting might in one sense be an advantage in this Canberra, flying practically at the stall. A sensitive Machmeter, were there such an instrument, would be useful. With atmospheric pressure only about one-tenth of that at ground level and temperature contradicting the tropopause concept at perhaps — 70 deg C, the I.A.S. would be only about 160 m.p.h. for a Mach number of 0.8.

Aircraft of high aspect-ratio are usually associated with high-altitude performances, and it will be recalled that the present record holder is a Vampire with considerably extended wing-tips. The Canberra, on the other hand, has quite low wing-loading with a relatively small-span, low-aspect-ratio wing. If money and facilities were available to produce an extended wing for a new record attempt, or should a requirement arise for a very high-altitude Canberra of greater span than at present, then with the full thrust of two Olympus 65,000ft might well be attained. We believe that de Havillands have thought about trying to improve their own record now that a more powerful Ghost is available for the Vampire, but no doubt other commitments have a priority call on the company's resources.

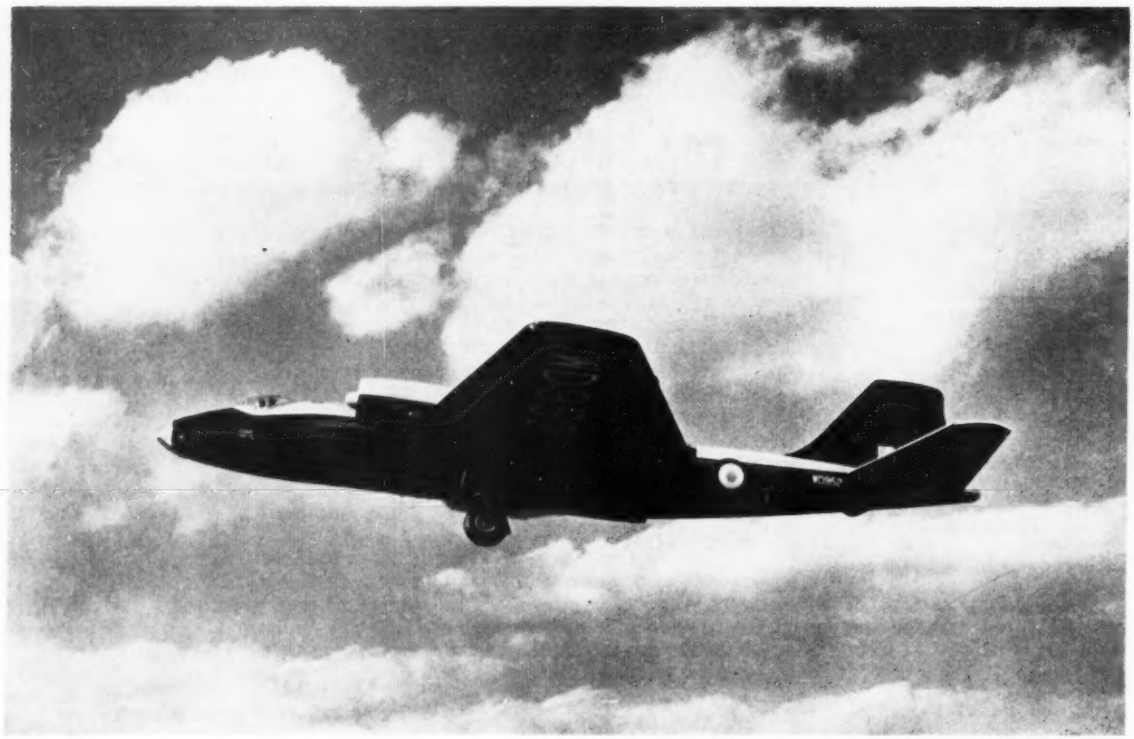
On learning of the 60,000ft (over eleven miles) flight of the Olympus-Canberra, the Minister of Supply, Mr. Duncan Sandys, sent a telegram of congratulation, adding "to reach these truly Olympian heights is a triumph for the pilots, designers, research staffs, and workpeople concerned with aircraft and engines." We understand that it was at the Minister's own request that, rather than wait an official attempt on the altitude record, it was decided to make the news of the flight public now.



"Flight" photograph

The Canberra test-bed for Bristol Olympus two-spool turbojets. The compact installations of these powerful units are well shown here.

If wheels are not retracted as the Olympus-Canberra takes off, the rapid acceleration may cause maximum wheels-down speed to be exceeded.



COSTS REVIEWED

The Auditor-General on the Proteus, Theseus and Phoebus

IN his report on the Appropriation Account for Supply, Food and Miscellaneous Services for the year 1951-52, Sir Frank Tribe, Comptroller and Auditor-General, states that expenditure on the development of the Proteus turboprop, which it was proposed to use in the Brabazon and Princess, amounted by March 31st, 1952, to £5,600,000. At that date the value of contracts placed for development, up to and including the Proteus 3 (to meet the revised requirement following the decision to suspend work on the second Brabazon and on two of the three Princesses), was estimated at £9 million—or over £13 million if related projects (the Theseus and Phoebus) were included. Additionally, the Ministry of Supply were liable for the cost of any parts, and work in progress, which the revision may have made redundant.

The report recalls that work on the second Brabazon and on two of the three Princesses was discontinued until Proteus 3s became available (the Ministry of Supply stated that this was expected to be in 1955). In the meantime, Proteus 2s would be used for the first Princess, but this engine had not developed the power envisaged and would not go into production.

A great part of the increase in the estimated cost of the Princess from £2,800,000 in 1946 to £10,800,000 in 1950 was attributed to the engines. The estimated cost of these had risen from £407,000 to £4,920,000 by 1952, and the airframes had had to be modified because of the changes in the type of engine to be used.

Sir Frank goes on, "The Proteus engine is the outcome of a proposal, submitted by an aircraft company, for developing in two stages an economical gas turbine engine of some 4,000-5,000 h.p. for large long-range transport aircraft." The first was a pilot unit, subsequently designated Theseus, of 2,000 h.p. It was later decided that the designs for the second stage of development should embody somewhat different principles, and in September, 1949, the Ministry decided that further work on the Theseus should be limited to the maintenance of engines which were being used in test aircraft. There was no other production of this engine. Its development cost £3,600,000.

By February, 1945, the Ministry decided to proceed with the development of a 4,000 h.p. unit, and an initial contract was placed for high-compression turbojets (Phoebus) and high-compression turboprop units (Proteus). Development of the Phoebus ceased after an expenditure of £600,000 had been incurred. It was decided that the Proteus should be fitted to the Brabazon for operational purposes and also to the Princess; the same engine was also adopted for the Britannia. By March 31st, 1952, expenditure on the development of the Proteus amounted, as stated, to £5,600,000, and if the pilot unit—the Theseus—and the pure-jet Phoebus were included, the total expenditure was £9,700,000.

Sir Frank calls attention to orders for valves placed with a firm whose prices ranged from 73 per cent to 357 per cent above prices quoted by another tenderer. He had been informed by the Ministry of Supply that there were indications that the low prices were quoted by the other firm to attract some part of the order and so to gain experience in design and production. These quotations, therefore, were not regarded as establishing a fair level of prices. The other firm had later quoted 55 per cent lower for two of the types of valve. "I observe, however," Sir Frank goes on, "that the reduced prices in March, 1952, for these two types of valve were still 73 and 90 per cent above those quoted at the same time by the other firm after experience of manufacture." In the three tenderings, where both firms quoted, the total difference in the prices tendered amounted to some £121,000.

Sir Frank reports that the profit of Power Jets (Research and Development), Ltd., for the year ended March 31st, 1952, was £1,136,790. Income was mainly derived from patents and included £1,141,902 from the United States Government. There was an unappropriated balance of £493,241. The Government acquired the whole of the company's issued capital for £250,000.

THE R.Ae.C. DESIGN COMPETITION

A Preliminary Report on the Winning Entries

AS most readers know, the Royal Aero Club last year organized an aircraft design competition of outstanding scope and interest. The contest was divided into three parts: two-seat light touring aircraft; single-seat racing aircraft; and single-seat aerobatic types. No less than 104 initial entries were submitted, this total being eventually reduced to a short list of 14 touring aircraft and five racers. The aerobatic class attracted no entrants.

Three independent teams of adjudicators—who must, for the present at least, remain anonymous—examined the designs submitted, and reported at a meeting held at the Royal Aero Club on Wednesday, March 18th last, under the chairmanship of Major R. H. Mayo, O.B.E.

As a result, the entries listed below were agreed upon by unanimous decision. At the same time the judges made the following remarks, which bear upon all the entries in general:

Touring aircraft.—The tourer entries in general show a good standard of design and, in particular, reveal the enthusiasm available for light aircraft projects. It is sincerely hoped that facilities will be available for the construction of those types worthy of mention. A formidable amount of work has been put in by many entrants, work which is, in fact, far in excess of the pecuniary benefits of a prize.

In general, conventional design is followed, the bubble hood, low-wing cabin monoplane, with side-by side seating, being very much in evidence, with a tendency towards the use of a butterfly-type tail unit. Most entrants favour metal construction and only one is a high wing monoplane. Another enthusiastic entrant submitted a most creditable biplane. The difference in merit between the first three entrants is considered to be exceedingly small and only after considerable discussion of detail points was it possible to arrive at a decision.

Racing aircraft.—Racing aircraft, although entered in small numbers show evidence of considerable design study. There is a preference by designers for the lightweight turbine-powered racer, although the airscrew-driven entries have many creditable points.

In judging the jet aircraft, the high initial cost had to be put in balance against the marked superiority in performance. These factors naturally influenced the assessment of the respective merits of jet and conventional aircraft since the latter types, whilst of inferior performance, had a comparatively low initial cost.

Technical remarks.—In all cases the investigations show that it is not possible to make a full assessment against the requirements for a Certificate of Airworthiness. It is therefore agreed that such an investigation must be the subject of a separate discussion between the designer (constructor) and the appropriate air worthiness authority.

It now seems inevitable that when an individual designer attempts to cover all the work normally carried out by several departments that errors in mathematical work go unchecked. The broad conceptions of the designs were, in general, nearly all creditable, the main failures appearing in detail work for low cost production.

Much of the costing was of an arbitrary nature and unlikely to stand close and detailed analysis. Only one competitor concerned himself with silencing his aircraft. When it is considered that noise is one of the major complaints levelled at light aeroplanes from pilots and public alike, this investigation is the more noteworthy.

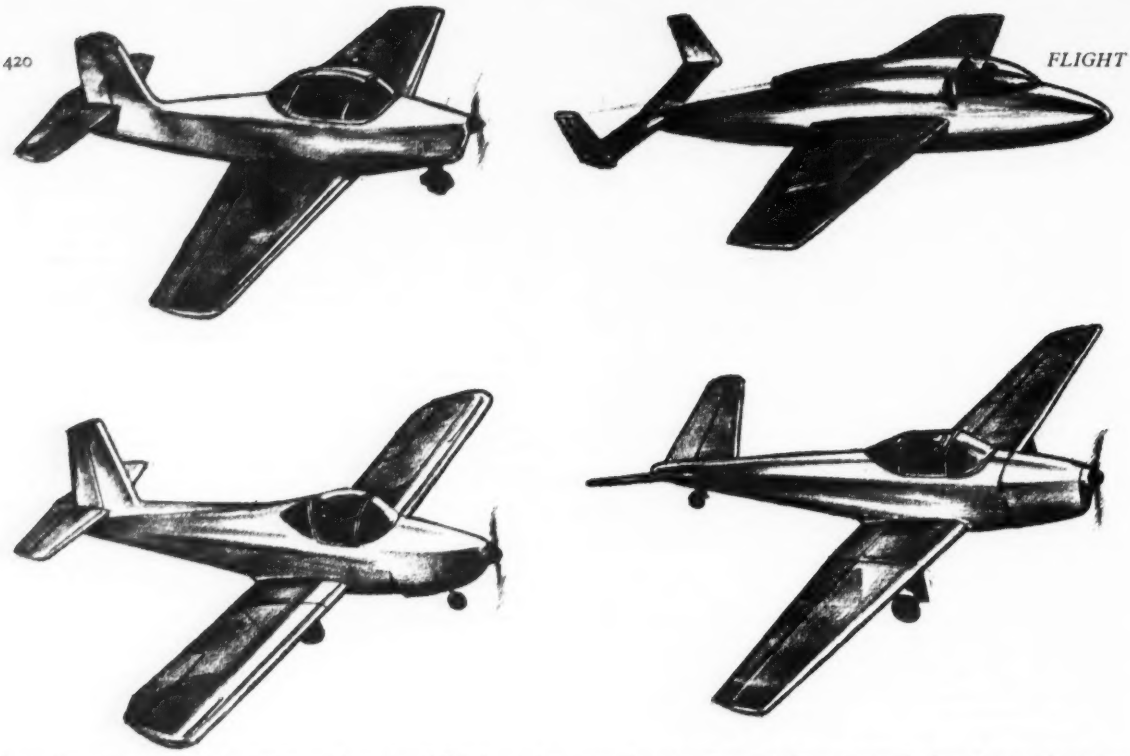
The judges feel that the results should be qualified by a brief resumé of some of the points considered worthy of mention from the aspect of possible production of these designs.

* * *

As related above, the winning entries were unanimously agreed upon. Unfortunately, space considerations preclude detailed discussion of the successful entries in this issue, but the following is an outline of the winning designs.

Touring aircraft, first prize of £100.—(H. K. Millicer, G. D. Bennett and J. M. Tutty of Melbourne, Australia). The design provides for a low wing, a fixed nosewheel-type undercarriage and a side-by-side cabin. Large, semi-slotted flaps are specified, so reducing the size of the wing and the all-up weight; inboard of the ailerons proper—which themselves are of the drooping type—the lift flaps behave as ailerons over a reduced angular range. The lateral controls are thus unconventional, although of a pattern which has been proved efficient on certain military aircraft.

The wing span and area are 25ft 8in and 117 sq ft respectively; the weight is calculated as 682 lb tare and 1,200 lb normal all-up. With a fixed-pitch airscrew (the "touring" engine specified in the contest is the Blackburn Cirrus Minor, de-rated to 75 h.p.) the winning entry has the following performance: minimum stalling speed, 44 m.p.h.; cruising speed, 113 m.p.h.; standard still-air range (16 gal), 360 miles; take-off distance to 50ft, 325 yd.



Four winners: tourer 1st prize (Millicer, Bennett and Tutty), top left; racer 1st prize (Boscombe Down Design Syndicate), top right; tourer 2nd prize (McFarlane), bottom left; and tourer 3rd prize (Boughton, Henson and Hart), bottom right. ("Flight" copyright drawings)

THE R.Ae.C. DESIGN COMPETITION . . .

The judges praised the simplicity conferred upon the design by the wooden construction, but considered that a metal structure would have had wider appeal. The curved transparent areas in the cabin top were thought to be a possible cause of visual distortion, and a fuselage fuel tank was also looked upon as an undesirable feature. Additionally, spats were not thought to be suitable for aircraft which might be used for flying instruction.

Touring aircraft, second prize of £50.—(L. G. McFarlane, Tottenhoe, Beds.) Mr. McFarlane's design—resembling a Navion, with folding wings—received commendation for its simplicity coupled with pleasing lines. It also showed unusual attention to considerations of safety, although the wing root fittings and spar booms appeared to need some modification.

Touring aircraft, third prize of £25.—(T. Boughton, G. S. Henson and J. E. Hart of Southampton, Hants.) The detailed design of this joint effort was considered of a high order, but the judges criticized the choice of a vee, or butterfly, tail. This latter feature might not lend itself to the use of simple control runs and could also introduce unknown problems in adverse conditions.

Racing aircraft, first prize of £100.—(The Boscombe Down Design Syndicate, A.A.E.E., Boscombe Down, Wilts.) So impressive is the composition of this syndicate that their entry could hardly have failed to be successful; but it should be remembered that entrants were no more than impersonal numbers to the judges. Members of the syndicate were: A. Cdre. A. H. Wheeler, director of the A. and A.E.E., Boscombe Down; Handel Davies, chief superintendent; F. H. Beer, superintendent of engineering; R. E. Webster, chief draughtsman; C. W. C. Chapman, leading draughtsman; Miss L. H. Harrison and Messrs. J. K. Moakes, J. V. Inglesby, J. Stephenson and H. W. Turner, all of Performance Division (the last-named is now C.T.I. at the E.T.P.S.); Miss E. L. Curtis (now at Faireys); W. Stuart, civil test pilot; J. W. Leach, Airborne Division; and K. A. J. Knell, who went to the U.S.A. before completion of the design.

This eminent group started by preparing a celluloid model of a "standard man" (to Spec. A.P.970) and then used it as a basis around which to build the smallest possible practicable racing aircraft. With the Turboméca Palas turbojet (entrants were given a choice of using this engine or the Cirrus Minor), the resulting design resembles the German He 162 Volksjäger fighter.

The span is but 14ft 8in and the expected speed at full power is 370 m.p.h. Construction is to be in wood throughout. Presentation of this design was highly creditable and suggested an aircraft of sound construction. On the other hand, it was felt that the narrow-track undercarriage might prove an embarrassment in cross winds and also that the effectiveness of the flying controls during the approach and at low air speeds generally required further investigation. From the point of view of "crashworthiness" a weak feature was the intimate positioning of the engine, fuel tank and pilot. Torsional stiffness of the wing was questioned.

Racing aircraft, second prize of £50.—(R. Prizeman, Chalfont St. Giles, Bucks.) Mr. Prizeman's entry gained by virtue of its simplicity and attractiveness and also for the provision of a 25 g seat and standard instrument panel in a cockpit of ample proportions. The fuselage-located fuel tank was criticised.

Racing aircraft, third prize of £25.—(J. N. Somers, A.F.C., and H. M. Kendall, Reading, Berks.) A special commendation went to this entry for its ability to be operated either as a single-seater—as specified in the entry conditions—and also as an occasional two-seater trainer or tourer. The undesirable features of the design generally paralleled those previously experienced, namely, location of the fuel tank in the fuselage, the adoption of a butterfly-type tail unit, and the fact that assumptions regarding laminar flow over the wings would not necessarily be realized in practice.

In spite of post-war difficulties which beset the light aircraft enthusiast labouring as he does under a multitude of restrictions, it is felt that the competition revealed that a high degree of skill and enthusiasm exists. This, together with the appropriate philosophy, may produce a valuable contribution to the export activities in particular, and the sporting field in general.

We hope to present a full analysis of the successful designs—both racers and tourers—in forthcoming issues.

THOUGHTS ON GAS TURBINES

IN the opinion of A. Cdre. F. R. Banks, expressed in an address to the Institute of the Aeronautical Sciences at Cleveland, Ohio, Britain leads the United States in the production of turboprop engines because her manufacturers "are not hampered by too much red tape and official interference." British methods of production and design were the best he had yet seen for "rapid action."

He was surprised that "any progress whatsoever" had been made with gas turbines by companies still principally concerned in developing piston-engines.

"We have increased the efficiency of the jet engine by about 20 per cent since the war," he continued, "and research is pointed at increasing it still further. It is still a long way from being as economical as piston engines for civil use. In my opinion it will take another ten years for the industrial organizations in this very specialized business to master the design technique and development of the aviation engine—and then only after bitter experience . . . many of these firms, in their struggle for success, will fall flat on their faces due to lack of sound engineering policy and good technical control. This would be the result, he continued, "of being overridden by bankers and accountants who came in at the top because of previous bad management and then tried to dictate technical policy."

ELEVEN MILES UP: The crew of the Olympus-Canberra which, as related on page 418, flew to over 60,000ft:—W/C. W. F. Gibb (left), Bristol assistant chief test pilot, and Mr. F. N. Piper, flight research department.

FROM ALL QUARTERS

Jungle King—and the Future

IT will take a long time before the full lessons to be learned from Exercise "Jungle King" can be sorted out and correctly analysed, but meanwhile—as outlined in our leading article last week—certain facts and conclusions are immediately available for discussion and assessment. Furthermore, one can obtain some idea of the shape of Bomber Command, and its mode of operation, in three or four years' time.

The tendency in the past has been for each new development to make Service aircraft more and more expensive, and this will be emphatically reflected in the future striking-force of the Command. If all goes well, there will be several squadrons of Valiants in service, and at least some Vulcans and Victors. The cost of each of these types will run into hundreds of thousands of pounds apiece—more than enough to offset the apparent economy of the relatively small numbers of aircraft concerned. The only actual economy will be in the number of aircrew required. These will be comparatively few, but will have to be the cream of Air Force personnel. Already a three-phase system is in operation in the Command, whereby crews are divided into "new," "combat nursery" and "selected" crews; and presumably the latter class, having proved their worth beyond question on the by-then obsolescent Canberras, will have their chance to graduate on to the heavier and faster V-bombers.

In this recent exercise over 100 Canberras took part in continuously recurring operations for a period of a week, and virtually no engine failures and only one serious accident—on blind approach—marred such a large-scale effort. In the future all bomber squadrons, other than those equipped with the later four-jet aircraft, will be operating Canberras, and it is comforting to think that engine maintenance at least has proved during "Jungle King" to be simpler with jet aircraft than with their predecessors. Maintenance of radio, radar, instruments and armament is another matter. The new aircraft generation substitutes speed for defensive armament, but in all other respects the ancillary equipment demanded by modern performance far exceeds that required for Lincolns or even Washingtons, and the shortage of expert ground-personnel poses an increasingly serious problem.

There is also the question of the guided bomb. Sir Hugh Lloyd himself has given some idea of his hopes of such a weapon, and it is reported that the Canberras at Woomera are already testing out electronic guiding equipment, whilst scientists and technicians are studying similar devices at Aberporth, Cardigan Bay. If H.E. bombs are to be dropped from a four-jet bomber flying at, say, 60,000ft and 600 m.p.h., at night, it is quite clear that some form of guidance is essential, the release point for the missile being so far away from the target as to preclude consistent accuracy, even utilizing the most modern techniques. With atom bombs the problem may not be so acute, but even then accuracy is extremely important, and in any event such weapons are too expensive to use for any but selected missions. An interesting point here is whether, in the event of a shooting war, the Americans would turn over any of their considerable stockpile of atomic bombs to the R.A.F., or whether we would only have use of our own, which are not likely to be particularly numerous.

Yet another point brought out by last week's activities has been the influence on modern operations of the infamous weather which so often plagues the United Kingdom. Basically, as is well known, jet aircraft cannot be stacked for long periods whilst awaiting their turn to land. Certain direct improvements have been made in this direction—Canberras are now receiving tip-tanks, engine design is improving, and axial-flow units in particular have better specific consumption: but this particular difficulty is with us for the foreseeable future, and its solution depends upon a variety of factors. Amongst these are better forecasting, early diversions, a sustained ultra-high standard of instrument flying for pilots, and more and better bad-weather approach aids.

G.C.A. is certainly proving its worth, but it may well become prudent to install in the V-bombers such "civil" aids as the Zero Reader and I.L.S., which can advantageously be used together, or even be coupled up to the auto-pilot to allow entirely automatic approaches to be made when weather is really bad and fuel nearly exhausted.

Royal Aero Club A.G.M.

THE annual general meeting of the Royal Aero Club took place at 119, Piccadilly, on Wednesday, March 25th. Mr. Kenneth Davies, the chairman, referred in his report to a number of successful occasions and activities, but in particular, he spoke of the great honour conferred on the Club by the patronage of Her Majesty the Queen and also by the Duke of Edinburgh's acceptance, last December, of honorary life membership.

In Mr. Davies' report was expressed deep sorrow at the death of Col. W. C. Devereux, vice-chairman and for many years chairman of the finance committee.

Among the many other matters, reference was made to the minor alteration in the design of the Club's badge (more emphasis is now placed upon the wings the serpents being treated as a secondary feature); to the appeal for a fund to erect a memorial to Alcock and Brown (the figure stands at £3,463 and further donations are required); to the exceptionally busy year of the records, racing and competitions committee under the chairmanship of Maj. Mayo; to the introduction of the highly successful British Air Racing Championship Contest; to the England-New Zealand air race; and to the 28 light aeroplane point-to-point records established by Mr. Tom Hayhow in his Auster Aiglet. The chairman also referred to the election of Capt. Bartlett as senior vice-president of the Federation Aeronautique Internationale.

At the end of the meeting, as is the custom, the Britannia Trophy was presented—this year, as already announced, to W/C. Beamont, F/L. Hillwood and S/L. Watson for the double Atlantic crossing in a Canberra. The Geoffrey de Havilland Trophy was presented to Mr. David Morgan for his London-Brussels record at 665.9 m.p.h. in a Supermarine Swift, and the Royal Aero Club Gold Medal to Mr. Philip Wills for winning the World Gliding Championship in Madrid.

Factory Fittings

AN interesting factory-equipment exhibition was held last week in the Royal Horticultural Society's fine new hall in Westminster. The exhibition was opened by Sir Miles Thomas, chairman of B.O.A.C., on March 23rd, and was visited by the Duke of Edinburgh the following day.

Most of the exhibits were, naturally, not directly concerned with aircraft, but some deserve mention. For example, William Moss and Sons, Ltd., of Cricklewood, London, N.W.2, demonstrated their Beanstalk and Giraffe mobile hydraulic working platforms, the latter of which is widely used for aircraft maintenance and was described fully in *Flight* of September 26th, 1952. Televox, Ltd., of Sloane Square, London, S.W.1, had on show their most interesting product, which seems likely to "catch on" in all walks of industry. Briefly, the device supplies loudspeaker facilities to the ordinary G.P.O. telephone, thus leaving the operator's hands entirely free. The telephone instrument is simply laid on its side in the Televox rack, and a controllable-volume amplifier unit does the rest. The device can also be incorporated with advantage in an office or factory private telephone hook-up.

New Welbeck, Ltd., of Bedford Road, Luton, exhibited their master cleaner, which is used extensively for cleaning out commercial aircraft. This remarkably silent electric device provides powerful suction or air-blast at will, beats when required to pick up cotton threads and other tiresome objects, and has the advantage of a rigid metal container, so that suction is not gradually lost as the bag becomes choked with debris.

Other miscellaneous items that are of interest to the aircraft industry were: industrial clothing in cotton, nylon and terylene—the Whaley Bridge Mfg. Co., Stockport; protective clothing—Siebe Gorman and Co., Ltd., Tolworth Surrey, who also, of course, manufacture Comet seat belts, M.C.A. oxygen regulators, and (to special order) high-altitude flying suits: hangar and factory scrubbers—Columbus-Dixon, Ltd., Wembley, Middlesex.

HERE AND THERE

TANDEM TOUCHDOWN: As reported on page 439, the French Government have ordered a number of Piasecki HUP tandem-rotor helicopters for shipboard operation (France has two carriers in commission, and most of her cruisers are fitted for aircraft operation). In this striking photograph, an HUP-1 is seen landing near Banshee F2H-2Ps on the deck of an American carrier.

F.A.I.'s Netherlands Meeting

FOR the first time, Holland is to be the venue of the annual general meeting of the Fédération Aéronautique Internationale, which will be held at The Hague from May 14th to 22nd. Prince Bernhard will formally open the proceedings in the Knights' Hall on Friday, May 15th. Mr. C. Kolff, chairman of the Royal Netherlands Aero Club and president of the F.A.I., will be in the chair.

Hot Spot

FIFTY-THREE aircraft, including 12 B-36s, took part in last week's atomic-bomb test at Yucca Flat, Nevada. A U.S.A.F. spokesman said that the intention was to give aircrews first-hand experience of blast and flash effects, and that similar tests would be held at later dates. It was not revealed how close the aircraft flew to the bomb, which was detonated on a 300ft tower.

Atomic Delivery

MR. HAROLD TALBOTT, Secretary of the U.S.A.F., said in Washington on March 25th that the design of American aircraft to use atomic weapons was lagging far behind development of the weapons themselves. "The need for developing aircraft to keep pace with atomic advances is obvious," he added, and said he was thinking of both power plants and airframes.

Hayhow's Farthest East

RECORD-BREAKER Tom Hayhow is beginning to run out of capitals for record-breaking purposes, so during Marshal Tito's visit to England he wrote to him asking permission to attempt a London-Belgrade record. The result, conveyed in a letter from the Aeronautical Union of Yugoslavia to the Royal Aero Club, was acquiescence and an offer of all necessary assistance at Belgrade. Hayhow will fly either his Auster Aiglet or the Mosscraft which he recently purchased. The distance from London to the Yugoslavian capital is 1,051 miles.

February Aircraft Exports

THE value of aircraft and parts exported from the United Kingdom during February was £4,436,024, compared with £3,608,082 in the corresponding month last year and £4,284,218 in February 1951.

Honour from France

AT the dinner on the occasion of the R.Ae.S. Louis Blériot Lecture, Mr. L. S. Armandias was honoured by the presentation of the Medaille de l'Aeronautique, "for achievement in the field of aeronautics." It was conferred on him, in the name of the French President, by Mr. Jarry, president of A.F.I.T.A. Mr. Armandias, who is the third British recipient of this award, is deputy managing director of British Messier, Ltd. He is also an experienced helicopter pilot, holding No. 5 licence in this country and No. 3 in France.

Five-year "Heartbreak"

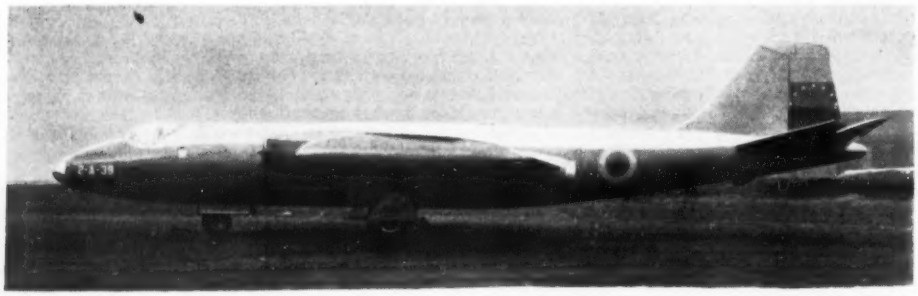
IN a recent speech at Shrewsbury, Lord de L'Isle and Dudley, Secretary of State for Air, said that the jet engine had brought about such a revolution in design and performance that the Hunter was as much in advance of the Spitfire as the Spitfire in its turn had been in front of the First World War's Sopwith Camel. The same applied to our new bombers. He continued: "I share the public disappointment that we have not yet got into service any British swept-wing fighters. But what you don't order you don't get. Neither the Hunter nor the Swift was ordered—and they were ordered 'off the drawing-board'—until the autumn of 1948, after the Berlin crisis; and it takes—this is the heart-breaking part—five years at least to bring modern fighters into service." Super-priority, added the Minister, had done, and was doing, all that was possible to smooth and accelerate the processes of production.

Sir Victor Goddard's Appointment

WITH the approval of the Queen, Lt-Col. D. C. Part, O.B.E., J.P., Her Majesty's Lieutenant of Bedfordshire, has appointed Air Marshal Sir Victor Goddard, K.C.B., C.B.E., M.A., a Deputy-Lieutenant of Bedfordshire. Sir Victor is principal of the College of Aeronautics, Cranfield.

The Last "Stringbag"

AN honoured arrival at R.N. Air Station Lee-on-Solent on March 24th was the last Fairey Swordfish in service. It has been in use for torpedo-dropping experiments at Gosport, and its rôle in its "retirement" at Lee-on-Solent will be occasional appearances at Naval air displays. It was ferried across by Cdr. H. S. Shaw, who served in Swordfish Squadrons during the war. These famous torpedo-spotter-reconnaissance biplanes, some hundreds of which were used by the Fleet Air Arm, had an honoured fighting history, which included the raid on the Italian fleet at Taranto and the memorable attacks on the *Bismarck*. The type first appeared in 1934.



UNFAMILIAR MARKINGS: Last week we recorded that the English Electric Co. had received an order for 12 Canberras from the Government of Venezuela. During Exercise "Jungle King" this one was seen at R.A.F. Station Binbrook; R.A.F. crews will probably take part in the delivery flights. Test-pilot Beamont left for Caracas last week.

The Fairey Gannet anti-submarine carrier-borne aircraft, in super-priority production for the Royal Navy, has also been ordered for service in the Royal Australian Navy.

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Design for Civil Air Transportation

The Flying-boat as a Key to Current and Future Problems

By G/C. W. N. CUMMING*

IS it not time for us to examine exactly where we are going with our plans for the future in the air? Before the 1939 war it was commonly assumed that flying-boat and landplane would each find its useful sphere of action, according to the terrain it had to serve. By the end of the war, for many reasons, the situation had radically altered. Transport aircraft were the monopoly of the United States, who from year to year built better and bigger models, and who were interested only in land aeroplanes. No new flying-boat, British or otherwise, was within measurable distance of taking the air commercially, to compete with the vastly improved economics of the latest American aircraft. The large numbers of new, runway airfields led to the belief—now known to be wrong—that, as they were ready made to serve existing aircraft, no further great expense need be involved.

Let us look at an array of facts, and add a few comments :—

(1) Experience to date shows that the largest aircraft which traffic will support is the most economical. (2) The ever-increasing weight adds ever-increasing price to the first cost and to the maintenance of airfields.

Comment: It is difficult to see how speeds can be decreased. Both economics and international competition demand otherwise. Unless, therefore, some radically new aerodynamic development, not yet in sight, permits the reduction of take-off and landing runs, the space required for first-class airfields will also go on increasing, and costs will continue to rise steeply.

As a corollary, the rapidly increasing size-specification for helicopters makes roof-top landing sites less and less practicable.

(3) Apart from the direct costs involved, the withdrawal from use of valuable ground is an ever more serious factor. (4) The public awareness of noise is becoming more and more assertive. (5) With increasing size, the flying-boat loses its initial economic disadvantage in comparison with land aeroplanes. This is quite apart from aerodynamic improvements in hull design.

Comment: It has been stated that at all-up weight of 500,000 lb, or more, the flying boat will become more efficient than a similar landplane. Within the limit of our present knowledge, it is also true that only aircraft of such weights, or more, will be capable of operating economically under atomic power.

(6) It has already been pointed out that the atomic bomb, whether delivered from the air or by sea, can put out of action our main harbours within minutes of the outbreak of war. Atomic bombs dropped by aircraft can equally render useless the small number of airfields designed to take our present types of long-range aeroplanes, let alone those of ten years hence. (7) From the purely military point of view, the United States has already decided that the flying-boat has a major place in strategic planning. Great efforts are being devoted to its development for such purposes.

Comment: Fact No. 7 is of interest only because it may lead to a position where the United States secures a comparable lead in flying boat design to that which they held in the design of transport aircraft at the end of the last war. That situation may well coincide with the realization that the transport flying-boat has a big rôle to play.

Much has been said in the last few years about the Princess flying-boats. From being the "white hopes" of British Air Transport, they have been discarded, revived, handed to the Royal Air Force, marked for use by independent operators and now put into an indefinite period of storage for lack of suitable power-units. There is not the slightest doubt that, as air vehicles, it would be criminal folly to discard them at this stage, if it is humanly possible to power them. Their potential as troop-carriers and as transport for strategic requirements is much too great to be thrown away. Nevertheless, they are even now out of date, and the future of the genus flying-boat must not be allowed to rest on the operation, successful or otherwise, of the Princess. Once already we have seen the flying-boat discarded because of a false economic comparison between modern and obsolete aircraft. Above all, we must not perpetuate the fallacy that because one operator has to bear the costs of marine bases, the flying-boat is over all less economical than the landplane.

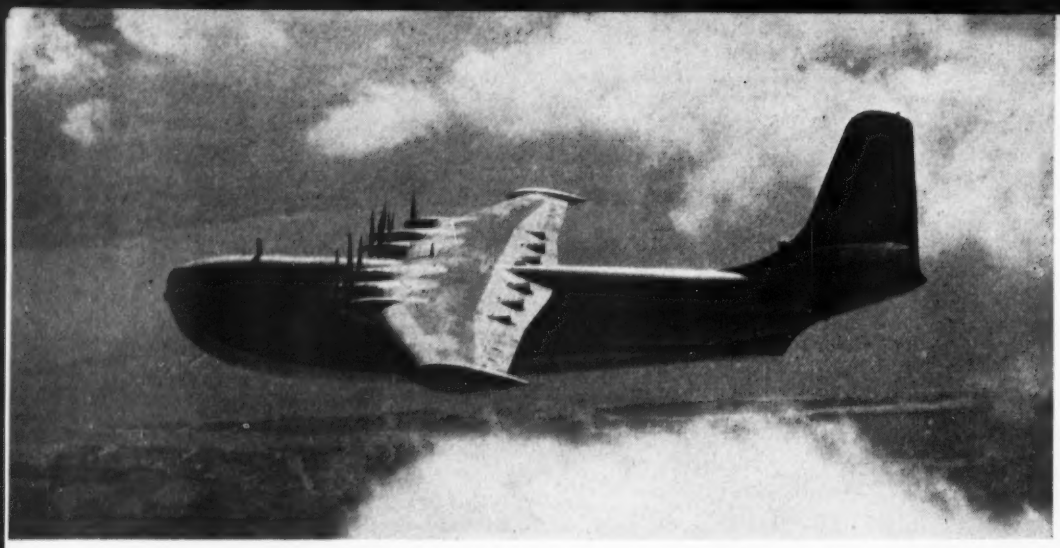
We have heard a great deal about reduced landing and take-off distances. So far, the competition in speed has won. We have gone a little way towards the distribution of landing loads. But is it really going to be possible to incorporate increasingly large numbers of wheels or larger caterpillar treads without adding an unacceptable figure to the structure-weight? Unless we do so, however, airfields will continue to increase in first cost and maintenance charges. And I will believe in a shorter runway when I see it in use for international traffic.

Here it is appropriate to consider communications between airfields, city centres and points of onward carriage. The problem of any form of transport is the traveller's—or the consignment's—connection with destination. We walk home from the tube or bus. We take tube, bus, or taxi from the railway station. We take a train from the docks. The pattern is simple, having developed with the requirement. Trains are the obvious onward method from docks, because the volume of traffic is such as to justify the laying of the necessary duplication of lines. Every railway station has a tube station or a bus stop. Buses and tubes are routed through points of greatest density, as are the operations of the road hauliers. The aeroplane operator alone has not devised a suitable method of onward transit from the airport.

In the early days, it seemed obvious that, the nearer to a city an airport could be sited, the better for all concerned. The contrary has proved to be the case. The operation of the aircraft themselves has been restricted by congestion and industrial murk. The roads on which the airfields are sited become so overburdened with traffic that the irritation and delay caused by arrival and departures go far to nullify the speed and pleasure of air travel.

I suggest that a new approach is necessary. The terminal airport should be not less than 50 miles from the city-centre of destination. I exclude most internal British services, which will

**G/C. W. N. Cumming, O.B.E., D.F.C., A.F.R.Ae.S., F.R.Met.S., has in recent years held a number of responsible offices, including those of master of the Guild of Air Pilots, chairman of the British Air Charter Association and council-member of the Air League. He served in both World Wars, was a civil pilot in Canada from 1926 to 1930, and was with Imperial Airways from 1931 to 1938.*



Great white hope—or white elephant? The Princess is already becoming dated but, given the opportunity, she will be able to demonstrate her real worth.

DESIGN FOR CIVIL AIR TRANSPORTATION . . .

in any case, soon be by helicopter. This terminal should be sited for its meteorological and physical suitability, and from it, for example, a mono-rail travelling at 200 m.p.h. should complete the journey, using the most practical approach to the city in question. I do not under-rate the problems involved, but they are certainly not insurmountable. In London's case they could well be integrated with the general re-planning. The noise problem would be solved, and the curious phantasy that to travel 17 miles in 45 minutes is preferable to travelling 60 miles in less than 20 minutes could be finally blown from our minds.

So far as the British Isles are concerned, therefore, if this thesis is accepted, flying-boats fill the bill for all major long-distance requirements, either for passengers or for freight. In the matter of the British Empire, there can, equally, be no argument with regard to the main services—as has already been proved. We are now in the curious position of building ever larger and more expensive airfields within a mile or two of great expanses of water, entirely suitable for the operation of flying-boats. Even where such water is required and is not available, it may well be cheaper to make a lake than a modern airfield.

One disability frequently attributed to the flying-boat, the difficulty in handling passengers and cargo, should not now arise. Today it takes an average of 45 minutes to get from city centre to airport. Before that, the majority of passengers have assembled for tickets and other formalities for which a period of at least 20 minutes is allowed, even on internal services. On arrival at the airport, all passengers are assembled and further formalities are completed. Conservatively, another 30 minutes elapses before embarkation takes place. Inclement weather is frequently accompanied by a considerable pause in the open.

Even before B.O.A.C. discarded the Solents, passengers and goods were embarked direct from the dock. No reason exists why this should not be by means of a covered way. The technique of docking a flying-boat is well established, and recent improvements in design and *reduction* in costs make such a method practical at all except the most unimportant stops.

Maintenance, too, becomes a simple matter on a large flying-boat. Power units, being completely accessible from within the wing, not only provide weather protection but eliminate the costly loss of tools overboard. To date, flying-boats have had to be beached at frequent intervals for hull cleaning and to receive a coat of lanolin. With the larger craft, if it be impossible to produce a metal impervious to salt water, there is no reason why a means of spraying lanolin while in flight should not be incorporated. Dry-docking should become an annual major operation, as with ships.

The larger the flying-boat, the more self-contained it becomes, because the cost of carrying its own powered dinghies, fire-fighting systems and mooring impedimenta not only represents a smaller proportionate loss in carrying capacity, but involves a lower actual cost in loss of potential cargo. This means that landings for traffic purposes away from main bases become practical. Only if refuelling is involved are any arrangements at all required. With the advent of atomic power even this requirement will vanish. And may I point out that, with the exception of atomic power, there is not one aspect of the above two paragraphs which could not be built into a flying-boat tomorrow?

So far as the flying-boat is concerned, therefore, we can say that in large sizes, say from the Princess upwards, the economics of operation should be at least as good as the best landplane yet devised. And those economics are at a stage where, apart from passengers, an enormous field of freight-development unfolds. Obviously, however, aircraft of such a size are practical only where loads justify such carrying capacity. My own estimate is that, given freedom to operate and to expand there will be, within the next ten years, a very large number of routes and projects on which aircraft of 500,000 lb and over can well be employed.

Just as we do not expect to use the *Queen Elizabeth* to carry passengers and cargo between Dublin and England, equally we do not expect large aircraft to serve all points from which traffic originates. It is ignoring reality to claim that such, in fact, is done by present landplanes. As the physical requirements for airports increase, the number of airfields available decreases. I have already shown that at least one hour and thirty-five minutes is lost between city centre and embarkation so far as passengers are concerned. Even that is only for those travelling to or from the city served by the airport. With freight, the delay is greater.

The primary purpose of air transport is speed. There are, however, many other advantages, some of which are not yet sufficiently widely understood. In the case of passengers, the ability to avoid irksome changes of vehicle ranks high. Comfort and cleanliness appeal to many. So far as freight is concerned, the consequential advantages are even greater—in the form, for instance of packing, insurance and lowered risk of loss.

I maintain that we can improve and cheapen present air transport by using the most economical vehicle, the large flying-boat, for the major part of the routes flown. I also maintain that by a proper integration of feeder services, the speed of arrival at destination can be increased and the tiresome and slow road journeys, airport delays and other inconveniences eliminated. I suggest that the following is the way to do it, in this country or in most others.

Main flying-boat terminals will be sited for strategic, traffic and economic reasons, and each terminal will have alongside it a medium-sized airfield, surfaced with grass or any other locally suitable alternative. From this airfield will depart main feeder services, carried out by aeroplanes with a maximum all-up weight of forty to fifty thousand pounds, having the necessary landing and take-off characteristics for such a purpose. A similar-size flying-boat with similar aerodynamic characteristics may be substituted where more appropriate.

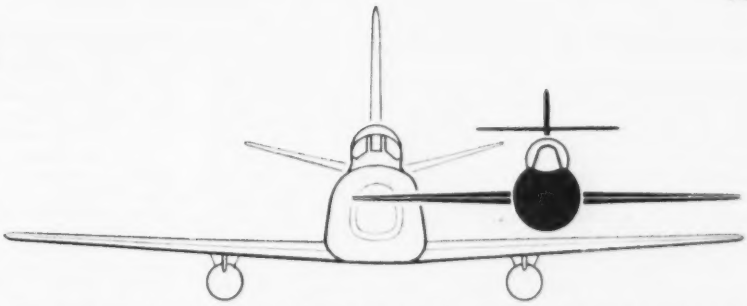
Helicopters can also use the terminal airfields, and will be capable of alighting in the centres of towns and industrial areas. The bulk of traffic proceeding to the nearest large centre will however, be carried by mono-rail, the city terminal of which will be the rotorstation of that city. Most customs and immigration facilities can be carried out either on the flying-boat or on the mono-rail. Covered ways and all facilities can be provided for passengers, even to the extent of using specially designed electric, diesel or motor vehicles where necessary.

Apart from the purely civil side of such a pattern, the strategic advantages are enormous. While it is easy for an enemy to neutralize harbours and existing main airfields, it would be impossible for him to deny us the use of the entire British coastline, without, of course, occupying the country in strength. In war, therefore, the fleet of flying-boats could alight at any selection of suitable points. Small airfields are much easier to provide quickly than the modern requirement of heavy concrete runways 3,000 yards or more in length. In emergency, helicopters could be used to maximum availability. A fleet of only 50 such flying boats could deliver well over 2,000 tons each day from Canada.

Although I do not pretend to be a student of military strategy, and although warlike requirements have nothing to do with my thesis, I cannot resist ending on the note that, from my own limited experience, the flying-boat as a combat weapon has a very definite function. The further it is developed, the more does this become so. From every point of view, therefore, it would be a tragedy were we not to carry on, not where we left off, but where we can now pick up the threads of the art of flying-boat design and construction.

THOUGHTS ON THE GNAT

An Introduction to the New Light Fighter



The small aircraft in this drawing is purely hypothetical. The illustration has been prepared to show the general proportions of the Folland Gnat in comparison with a Sabre. That the Gnat will have at least as much power as the early Sabres gives some idea of the possible performance.

THE Gnat is a light fighter project under development by Folland Aircraft, Ltd., of Hamble, Hants. Before going on to discuss this most interesting aircraft—in the greatest detail permitted by security considerations—it will be as well if the term "light fighter" is clarified, if not defined.

This can best be done by stating what a light fighter is *not*. It is not a normal fighter stripped down to the bare airframe in order to save weight. Again, it is not a target-defence intercepter capable of doing no more than climbing rapidly to altitude, making a single firing pass, and descending again in a glide with fuel exhausted—neither is it a conventional fighter stressed to a lower load factor in order to permit lighter construction. The true light fighter is a design in its own right, built to its own set of requirements, and making, if anything, less compromises than usual.

Readers wishing to pursue the genesis of the light fighter in greater detail are referred to our issue of November 7th last. Additional information which has become available since that date reveals that light fighter projects are under development in a number of western countries. In Italy, for example, Dpl. Eng. Casiraghi is collaborating with the Piaggio Company on such work, and in France the newly-formed S.F.E.C.M.A.S. group is reported to be developing a small fighter with a delta wing.

Of greater importance than these projects is the fact that the United States Air Force is reported to be very interested in the possibilities offered by light fighters, and development and prototype contracts are likely to be issued within a few weeks. Reports have it that North American Aviation is the company most likely to succeed in filling such a specification, and it is known that stripped-down versions of the Sabre have been under consideration by North American for a considerable time. It is appropriate to recall that a similar version of the Mustang was developed by the same company in 1944. Whether a drastically simplified Sabre would be an efficient aircraft is doubtful.

The Gnat, on the other hand, is entirely a private venture, and largely the work of one man. It may be remembered that Mr. W. E. W. Petter, after becoming famed as chief designer of Westland Aircraft, went to the English Electric Company where he produced the Canberra, undoubtedly his *magnum opus* to date. In October, 1950, he went to Follands where he is now managing director. After taking over at Hamble, Mr. Petter made a thorough study of the economics of modern fighter production, and came to the conclusion that all present fighter aircraft represented far too great an expenditure in manhours and material. Further, some disinterested persons have expressed the view that, were a shooting war to break out, this country could not produce aircraft such as the Swift, Hunter, and Javelin in anything like the numbers essential for survival.

Admittedly, the Air Staff are favouring a "quality not quantity" doctrine at present, and the world-beating quality of the three types just mentioned has never been questioned, but whether this country is economically in a position to mass-produce such aircraft is questionable, to say the least.

Air Chief Marshal Sir Basil Embry, at present C.-in-C., Fighter Command, has also been examining the fighter-defence picture with an eye on what might happen were heavy daylight air attacks to be launched against these shores. His conclusion was that defending fighters should, for acceptable results, outnumber the attacking force. Those who, remembering the Battle of Britain, challenge this conclusion are reminded that not only is the modern bomber capable of flying almost as high and as fast as the best fighters, but in the realm of atomic bombing 100 per cent of the attacking force must be killed before it reaches the target. In any case, whatever the quality of the defending fighters, it would seem that numbers must be answered by numbers.

Mr. Petter studied the range of engines available and came to the conclusion that one or two turbojets then under development might prove suitable for such an aircraft. It is not thought that he visualizes the use of ramjets or rockets, either as main or auxiliary power units. Assuming an engine thrust of 5,000 lb, it appears quite possible to produce a fighter grossing less than this, so permitting sustained vertical climb and an order of performance exceeding that of any fighter now being built. During the past 18 months, the Folland design staff have pushed steadily forward with the development of the aircraft which has now received the company name of Gnat. So far, official backing has been conspicuously absent, but no time has been lost on this account. Work on a prototype is progressing to schedule.

Little can be said of the type of engine likely to be used in production Gnats. According to *Aviation Week*, Rolls-Royce, Bristol and Armstrong Siddeley all have suitable axial engines under development, but for our part we can say nothing beyond the fact that the engine will be an axial turbojet built to normal standards and in no sense a short-life engine.

For a fighter of this nature it might be imagined that Durestos or a similar resin-bonded fibre plastic might profitably be used in the structure. In the event, this is not so, for the Gnat will have a normal metal stressed-skin structure, flush-riveted. Machined members are gratifyingly absent and, in particular, there is an almost complete lack of forgings and large castings. The airframe is capable of manufacture in jigs of the simplest geometry and, according to the company, no special skill or tooling is required.

Mr. Petter was also faced with the choice of fitting a normal undercarriage, or adopting the catapult and flexible-deck technique, using belly skids. It can be said that the Gnat undercarriage will be quite normal and, due to the light weight of the aircraft, operation from good grass fields should be entirely possible. The landing speed is bound to be high—as it is on all modern fighters—but deceleration should be rapid enough to permit operation from spaces far more confined than could be used by larger fighters. With a good power/weight ratio, angle and rate of climb should be very great.

A Gnat wing has already been made and it appears that, on a production basis, this wing could be produced at a quarter of the cost and less than one-fifth of the manhours of a wing for a conventional fighter. Having seen this prototype wing—currently undergoing severe static testing—we can say that it impresses both by its simplicity and by the standard of its finish. Follands express themselves well pleased with its performance under load, which exceeds all calculated estimates.

The pilot of the Gnat need have no fear that he will be subjected to conditions more uncomfortable or dangerous than are experienced in the cockpit of, for example, a Meteor. Full cabin pressure and temperature control will be provided, and also an ejection seat. The latter feature is particularly interesting in view of difficulties experienced in accommodating such a device in much larger aircraft; and it also underlines the "conventional" nature of the new fighter. The question of armour cannot be stated definitely, but it would be surprising if the pilot were left unprotected; in any case, the Gnat should qualify as the world's smallest and most elusive military aircraft.

Other choices facing Mr. Petter were the adoption of complete electrics or hydraulics throughout the aircraft as opposed to a simplified circuit operated by a ground-charged accumulator. Again, the question of primary flying controls is one of absorbing interest; it will be interesting to find out whether Mr. Petter and his team have adopted the all-flying tail, and equally, whether the control circuits are powered or if they rely on spring-tabs.

On the question of armament, of course, little specific information may be divulged. If cannon are to be used, it is unlikely that they will be placed in the bottom of the fuselage for, on a small and light aircraft, their recoil would produce very severe nose-down change of trim. Spin-stabilized unguided rockets of the type now carried by so many American fighters offer a possible alternative, while one must not rule out the possibility of larger,

THOUGHTS ON THE GNAT . . .

guided, missiles as primary offensive armament at some later date. Air Chief Marshal Sir Ralph Cochrane, formerly Vice-Chief of the Air Staff, is known to be an advocate of fighters which can also be used as low-altitude ground-attack aircraft. This implies stressing to a basis of something like 12 g, and we would not be surprised if the Gnat is found to fall into this category. If so, the utility of the aircraft would be greatly increased at only a very slight penalty in airframe weight. In fact, one might go so far as to say that the Gnat could become a dominant factor in its tactical rôle in ground battles.

On the score of performance, it is advisable to study the small sketch at the heading of this article. Bearing in mind that the Gnat and the Sabre both have engines of something like the same thrust, it is not difficult to visualize rate of climb and high-altitude manœuvrability of an order at present only dreamed of. Certainly the Gnat should be capable of out-flying any opposition which it is likely to meet between now and about 1957—with the further advantage that it could be brought into service after an unusually short development period due to its simplicity. Follands have already pronounced the Gnat capable of a level of performance equalling, or exceeding, that of larger fighters, and with a 1 : 1 thrust/weight ratio there is no reason why Mach one should not be comfortably exceeded in level flight.

From the joint viewpoints of high-altitude manœuvrability and stalling speed, wing loading is the dominant factor. It appears that a wing of 150 sq ft could be built, with a span not much more than 20ft, in which case an all-up weight below 6,000 lb would result in a wing loading below 40 lb/sq ft. The Gnat, therefore, could be equal to, or better than, its larger contemporaries in this respect. Unfortunately, nothing may be said of the type of wing plan designed, but it may be confidently expected that both thickness/chord ratio and aspect ratio will be of a suitably low value.

In service, the Gnat would be regarded as a fighter for daytime work only. One of the most effective means of employing such aircraft would be to trail them in a loose formation behind a "master fighter" which could be either a Canberra or a Javelin. The master fighter would be responsible for long-range interception of the enemy force and general control over combat tactics and navigation. After breaking off the engagement, the swarm of Gnats could find their own way home, using V.H.F.—perhaps in conjunction with A.D.F. ground equipment like the Marconi AD. 7092A—and the possibility of a suitable navigation aid carried on board should also not be discounted. In any case, the Gnat would presumably be subject to current Fighter Command close-control procedures.

From the ground servicing aspect the Gnat scores over larger aircraft on several counts. First, the whole airframe has been designed to permit very rapid breakdown of the structure into its main assemblies—for example, a complete wing can be taken off and replaced by a new one with a minimum of fuss and bother. Secondly, the structure-weight is sufficiently low to eliminate the use of cranes for all but the largest portions. Finally, the Gnat will be built so low to the ground that staging and ladders will be rendered quite unnecessary.

In spite of the apparent apathy of the Ministry of Supply towards this concept, the whole design seems so obviously correct and natural that it is bound to bear fruit sooner or later. To quote but a few applications, the design is such that it can readily be mass-produced by the NATO countries, which could thereby contribute greatly to their own defence; this contrasts sharply with the present picture in which America has several times expressed dissatisfaction with the return being shown for M.D.A.P. assistance. Financing a Gnat production programme would not appear to be an insuperable burden on any NATO country, and the fact that General Boyd's M.S.A. pilots are over here to fly the Javelin may enable them to improve their acquaintance with the Folland project. As an "off-shore" aircraft, it could be a very great dollar-earner, and it would also seem to be an excellent machine for export to countries too poor to buy aircraft of the calibre of the Hunter, Swift and Javelin.

In conclusion, it may be remarked that the vicious circle of equipment-weight and structure-weight has never been felt so acutely as in the design of the Gnat. As an example, it appears that every pound added to the weight of equipment carried results in an increase in empty weight of 11 lb, and an increase in all-up weight approaching 20 lb, for equal range and performance. Here would seem to be an excellent opportunity for component manufacturers to produce a really suitable range of "miniaturized" equipment—circuit breakers, instruments and the like—which would also find a ready market in numerous heavier types of aircraft.

W.T.G.

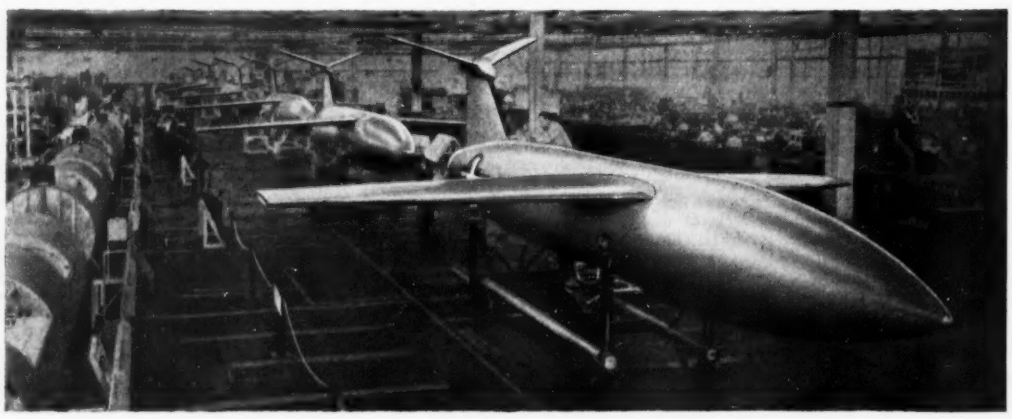
MARTIN MISCELLANY

THE accounts of the Glenn L. Martin Company, of Baltimore, have shown a tendency to be in the red at certain times since the war, but last year a significant return to profitable operation was made. Mr. George M. Bunker, president of the company, stated recently in his annual report that sales had increased from $68,480,519 (£24,100,000) to $143,999,382 (£50,750,000) during the past year, and that debts had been reduced by approximately half to $27,000,000 (£9,500,000). The products being manufactured by Martin are of unusual variety, since much of the work in hand is concerned with guided missiles of various sorts.

In the sphere of piloted aircraft, the company are in production with the P5M-1 Marlin and the B-57 Canberra. The latter needs no amplification so far as *Flight* readers are concerned, but it may be useful to recall that the Marlin is a twin-engined flying boat designed specifically for anti-submarine warfare. A crew of seven is carried, and extremely powerful tactical radar is standard equipment. The engines are Wright R-3350 Turbo-Compounds, and the aircraft is fitted with hydroflaps for turning and braking when waterborne. Another feature is the long, deep hull, which is intended to shorten take-off run and facilitate landings in rough seas. The only other aircraft which Martin have recently been manufacturing is the 4-O-4 forty-passenger airliner: over 100 of these have been delivered, and production is now completed.

In the field of missiles, the company are building the B-61 Matador pilotless aircraft, the Viking rocket, and the KDM-1 Plover target drone. The Matador is a swept-wing machine which utilizes rocket power to assist its J33 Turbojet for take-off; it is sometimes referred to as a ground-to-ground guided missile and is claimed to be the first pilotless aircraft to be manufactured on a production basis. The Viking is a single-stage, high-altitude research rocket which has proved to be of considerable value in the study of ballistics as well as of the upper atmosphere. The Plover is the production development of the Gorgon IV ramjet test vehicle. It is fitted with a 20in Marquardt engine, and can be guided by remote control. When fuel is exhausted, the machine noses up to lose velocity, and then descends by parachute for salvage and re-use.

Still further from the sphere of aircraft production, the Martin company is also fully engaged on the manufacture of a variety of electronic devices, such as area defence systems, guidance systems, radar, and telemetering equipment. Research, too, is considered to be of paramount importance, and is being increasingly carried out in all fields in which the company has interests.



Quantity deliveries of the B-61 Matador began last year; this photograph shows a number on the final assembly line. Notable features are the high tailplane—now with dihedral—and the wing, the anhedral of which belies its sweep. The engine intake is underneath.

The target that *disappears*

If only a submarine kept still, like other targets attacked by bombers, the problem would be easy. But an anti-submarine aircraft must press home a complicated, split-second attack against a small, slippery foe who will be out of sight and out of harm's way if there is a single mistake or hesitation. The Avro Shackleton is equipped, as only a *large* aircraft can be, for this vital attack role. The Avro Shackleton is the only land-plane providing enough space for the planning and execution of a well co-ordinated and deadly strike. Its enormous bomb bay has ample capacity for bombs, depth charges and the latest anti-submarine weapons. Its four Rolls-Royce Griffon engines give matchless reliability. The Avro Shackleton is in full squadron service with Coastal Command and production proceeds apace.

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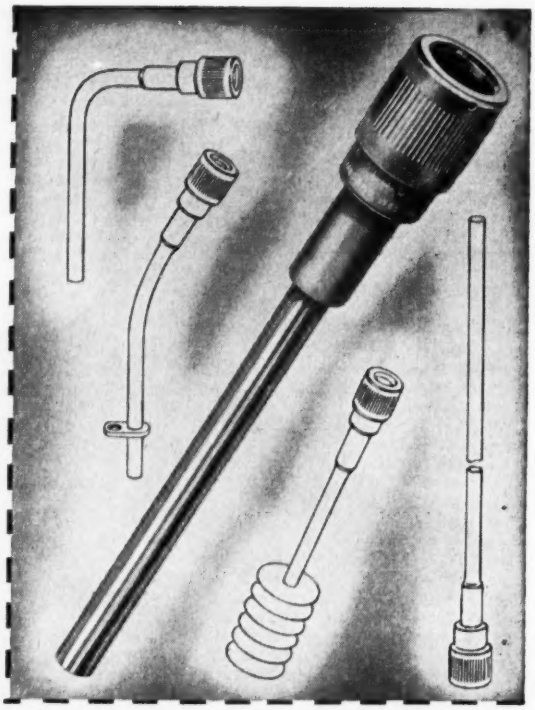

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HELICOPTER LANDING GEAR

Some Problems the Designer Must Face

BY MAURICE F. ALLWARD

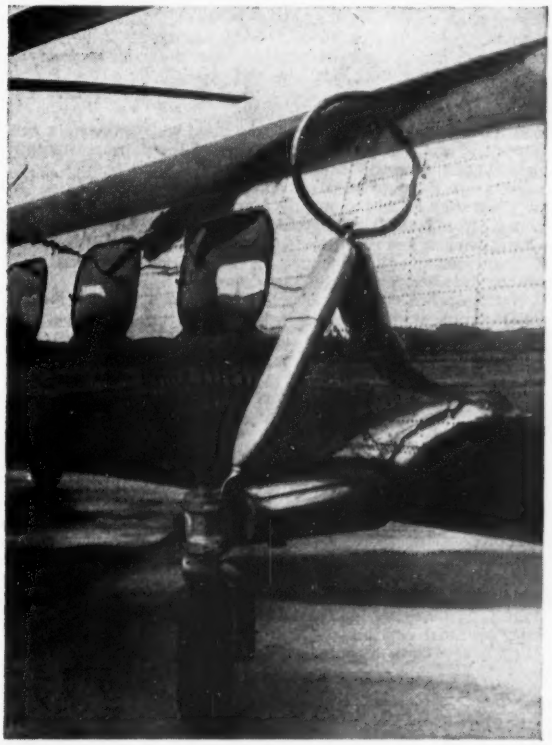
AT first consideration the development of suitable landing gear for helicopters, with their unique ability of being able to make vertical or near-vertical take-offs and landings, appears a simple matter. In practice, however, many factors and problems arise that are not encountered on fixed-wing aircraft. These combine to make helicopter landing gear an item requiring specialist attention.

The tyre is a good example with which to start. It would appear that these need only be "bags of wind" to cushion slightly heavier-than-usual landings. Although lightweight, thin-walled tyres might well be adequate to cater for the landing loads, experience has shown that these rarely have the robustness and resistance to damage that is required during ground manœuvring, when numerous obstacles such as stones and similar rubble are encountered.

The geometry of the undercarriage of a number of helicopters is such that the wheels travel sideways as the oleo-leg is compressed—on the Bristol Type 171 the movement is nine inches. This tends to roll the tyre sideways, imposing a severe scrubbing action on the tread and high stresses inside the tyre. Towing can produce similar damaging conditions on helicopters fitted with non-castoring wheels.

A further factor demanding the serious attention of designers is that of ground resonance—the unbalanced reactions set up by the rotors when running-up on the ground, an effect which can build up to dangerous magnitudes. One answer to this problem is to increase the tyre-inflation pressure to a figure far in excess of that required to cater for the normal dynamic loads, in order to provide as little undamped energy as possible. If this solution is adopted, however, a still heavier tyre-construction becomes essential. The operation of helicopters from ships necessitates high tyre pressures for a similar reason, since any tendency for a helicopter to rock on soft tyres can soon lead to trouble in high winds.

On some American helicopters orthodox measures have failed to dampen the resonance sufficiently, and it has been necessary to fit solid tyres. At best a palliative, this step necessitates re-designing the undercarriage with a suitably increased reaction.



The peculiar "hoops" projecting from the sides of the prototype Bristol 173 are part of the "resonance cure." This undercarriage was experimental; later versions have a considerably cleaned-up unit.

Lightweight "split" wheels to simplify tyre-fitting were developed by Palmers for the Bristol 171 Mk 50. The geometry of the undercarriage is such that the wheel moves sideways as the oleo-leg is compressed, so the tyres must be able to stand up to heavy loading.

On the Bristol Type 173 the cure for the severe resonance experienced during the initial trials was effected mainly by cross-connecting the undercarriage shock-absorbing systems and by refining the damping system of the rotors. The tyre-inflation pressure was increased, but this formed a comparatively minor part of the treatment. The peculiar "hoops" projecting from the sides of the prototype 173 are part of the cross-link system and are eliminated in the cleaned-up undercarriages fitted to later versions.

Brakes—As with tyres, the maximum loads imposed upon the brakes often prove to occur during the ground handling of helicopters and not during landing or take-off.

Although helicopters almost always have some forward speed when landing, the resultant kinetic energy is very low when compared with that of a fixed-wing aircraft of similar weight. There is thus little heat to dissipate, and the brake drum or disc, instead of doing duty as a heat reservoir, merely serves as a friction surface. The drum or disc can, therefore, be of lighter construction than is usual in normal aircraft, with a consequent saving in weight.

Wheels—Generally speaking, wheels designed specifically for use on helicopters are of lighter construction than those of similar size used on fixed-wing aircraft. Also, because any rotation is relatively of both shorter duration and lower speed, the ball or roller bearings usually fitted to aircraft wheels can be replaced with plain bearings; this results in a useful saving in weight.

The Air Horse provided a good example of what can be achieved by close co-operation between the landing-gear specialists and the airframe constructor. The wheels of the Air Horse look ridiculously small compared with the vast bulk of the rest of the machine and from ordinary considerations they *are* small.

The answer lies in the fact that the whole undercarriage is one of many novel features incorporated in the design. Because the machine was originally conceived as an aerial crane for the lifting of awkward high-density loads over rivers, or for carrying large tanks of insecticide for crop spraying, it was obvious that for most of the time it would be flying very close to the ground—too low, in fact, for the rotors to go into autorotative pitch in the event of engine failure. For this reason it was decided to fit an undercarriage capable of absorbing the energy of a high-velocity descent such as would result from the engine cutting at a moderate height above the ground. The legs, designed by Automotive Products, Ltd., have a free travel of no less than five feet. The three legs can absorb the energy equivalent to a free drop of 26 feet by the whole machine, the maximum load in each leg

HELICOPTER LANDING GEAR . . .

under these conditions being about eight tons, and the deceleration about 6½ g.

If the wheels and tyres had been designed to the normal requirements of ordinary aircraft they would have been extremely heavy and large and, with six of them exposed, their drag would have been appreciable. It was, therefore, decided to fit wheels which would be quite capable of dealing with all normal taxying and landing loads, but which, in the event of a forced landing, would distort severely but still be capable of rotational movement. The writing-off of a set of wheels on such comparatively rare occasions—so long as the main airframe was relatively undamaged—was considered justifiable in view of the advantages gained under normal conditions. The Palmer wheels were cast in magnesium-zirconium to reduce weight still further.

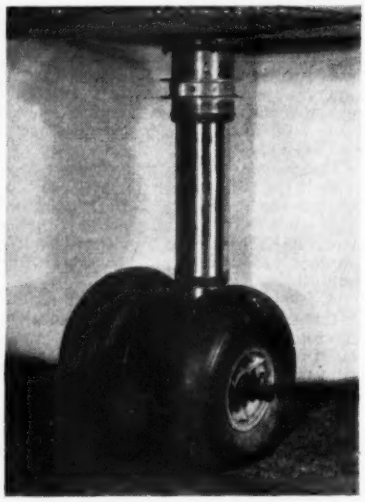
Considering helicopter wheels as a whole, whether the persistent vibration associated with present-day machines will lead to premature fatigue-failure remains to be seen, and it is something which requires close attention.

Floats—The widely varied duties of helicopters sometimes necessitates the replacement of wheels by floats, thus enabling them to operate from either water or land. Early floats were of simple cylindrical shape and were made along the same lines as a rubber dinghy. Experience soon showed that the addition of a tough chafer-strip on the underside permitted the use of floats on both land and water, without undue risks of punctures. Internal sub-divisions were provided as a safety measure and on the latest floats these bulkheads are designed so that if any one compartment is punctured the two adjacent bulkheads come together and retain the float in its normal shape.

A further refinement is the provision of upper and lower chambers attached to the outer surface of the main chamber. Within the upper chamber a rubber diaphragm is stretched tautly over the upper surface of the main chamber. The lower chamber is connected by pipes to the underside of the diaphragm On touching down, the lower chamber slowly deflates by passing its air into the space between the diaphragm and main chamber and the diaphragm inflates like a balloon. When the load is removed, the action of the diaphragm forces the air back into the lower chamber. This ingenious arrangement reduces any tendency to bounce and damps out the resonance forces when alighting on waves.

An ordinary low-pressure float has to be rigidly supported to prevent collapse when taking-off from water, or when taxying. The supporting framework required is unavoidably heavy, and in an attempt to save both weight and obtain improved rigidity during taxying The Palmer Tyre, Ltd., co-operated with the Bristol Aeroplane Co. in developing a novel relatively high pressure float for the Sycamore. The intention was that the high pressure would give the float sufficient rigidity to enable it to act as a stressed member, thus eliminating the need for heavy rigid longitudinal members and, in addition, helping to ease the problem of resonance. Another feature of this float was that it was of streamlined shape to reduce drag.

(Left) Neat metal floats fitted to a Sikorsky H-5H. The wheels permit forward speed during ground landings and take-offs and facilitate ground handling. (Right) Solid tyres on the McDonnel XHJD-1 Whirlaway.



Abnormally small weight-and-drag-saving wheels of the Cierva (Saunders-Roe) Air Horse. The wheels and special long-travel undercarriage (the front leg of which is seen here in the compressed state) are capable of absorbing the energy equivalent of a free drop of 26ft.

A number of helicopters have been fitted with lightweight metal floats, and it may be that these will prove a better proposition than the idea of a stressed-fabric float.

Although floats permit helicopters to operate from either land or water they do not allow any forward speed during landing or take-off from land, and the ground handling problem is aggravated. One answer to this is to provide wheels as well—but then there is a consequent further increase in weight and complication to reduce the already severely limited payload.

Again, operational experience in Korea has shown that for some duties simple skids are the answer. No, the helicopter specialists' lot is not a happy one.

N.G.T.E. APPRENTICES REWARDED

AT a recent gathering of apprentices, parents and staff held at Whetstone, prizes were presented by the Director of the National Gas Turbine Establishment, Mr. H. Constant, C.B.E., F.R.S., to five outstanding apprentices during 1952.

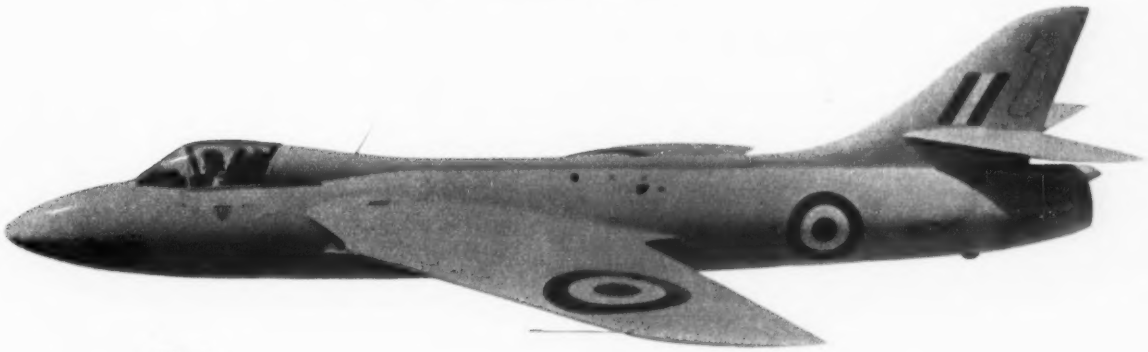
The Establishment has nearly 50 apprentices under training, of whom four are attending full-time Degree courses, and the remainder are taking part-time courses of instruction at the Leicester College of Technology and Commerce. Prize-winners were selected from boys in the latter category on the basis of technical and practical achievement, and were as follows: second-year engineering apprentice Harry Price obtained Ordinary National Certificate, Mechanical and Electrical, with five distinctions; first-year engineering apprentice Peter Glassford, two distinctions and two credits in Inter Science, first year; third-year craft apprentice Derek Green, City and Guilds Inter. first class, and Ordinary National Certificate; third-year craft apprentice Trafford Preston, City and Guilds Inter. first class and Ordinary National Certificate; second-year craft apprentice Berman Cummings, City and Guilds second class in his second year.

During 1952 the Establishment's apprentices secured the following: B.Sc., Engineering (London), 2; B.Sc., Engineering, Part I, 2; Ordinary National Certificate (Mechanical), 11; Ordinary National Certificate (Electrical), 3; City and Guilds (Inter.) (Eng.), first class, 3; second class, 1.

Super priority

Hunter

Super-priority orders have been placed for Sapphire-engined Hawker Hunter F.2 fighters for the Royal Air Force — another example of the part which the Armstrong Siddeley Sapphire turbojet is playing in the defence plans of the Western World



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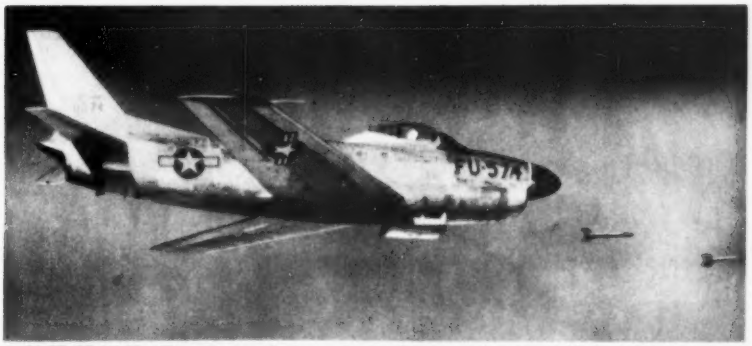


A CAGE OF MICE: This photograph shows, for the first time, the retractable box of Mighty Mouse rockets mounted under the F-86D Sabre. It is remarkable that such a device can be pushed out into the airstream at high speed without introducing severe nose-down pitching and loss of airspeed.

U.S.A.

North American F-86D Sabre. On this page in our February 27th issue, reference was made to the all-rocket armament of a number of all-weather fighters. Three of these aircraft were the Lockheed F-94C Starfire (24 rockets around the nose, plus a further dozen in an optional pod on each wing), the Northrop F-89D Scorpion (24 rockets in a pod on each wing-tip) and the Avro Canada CF-100 (30 rockets in a pod on each wing-tip, plus a further 40 in a fuselage tray). All these aircraft are two-seaters. The North American F-86D, on the other hand, is a single-seat aircraft, and its pilot has the task of monitoring the operation of the radar interception equipment, the radar gunsight and the autopilot—the two latter being coupled together in later Ds to provide automatic locking-on. When the radar ranging registers firing range, the rocket-tray under the belly is automatically lowered and the missiles—24 "Mighty Mice"—rippled away, as shown in the photograph on this page. No guns are carried. It may be remarked that the Sabre appears to feature a better installation than the Starfire, for the latter aircraft flies through a thick smoke-cloud while the rockets are being fired which, *inter alia*, must starve the engine of combustion air.

Douglas Jet Transport. More reports are arriving regarding the probable configuration of this important aircraft. Some are conflicting, but many affirm our recent contention that the wing will be "a crescent," although not necessarily following the Handley Page formula. The favoured engines appear to be the Pratt and Whitney J57 and the Curtiss-Wright J65 Sapphire; but the British-built Avon is also spoken of as a possible.

Republic XF-84H. It is now known that this experimental arcraft will be powered by an Allison T56. This is a double turboprop unit, consisting of two T54s, driving a supersonic biplane airscrew through common gearing and a single final shaft. The T54 is a 3,750 h.p. development of the T38 and it is earmarked for an enlarged version of the Lockheed C-130 cargo transport.

France

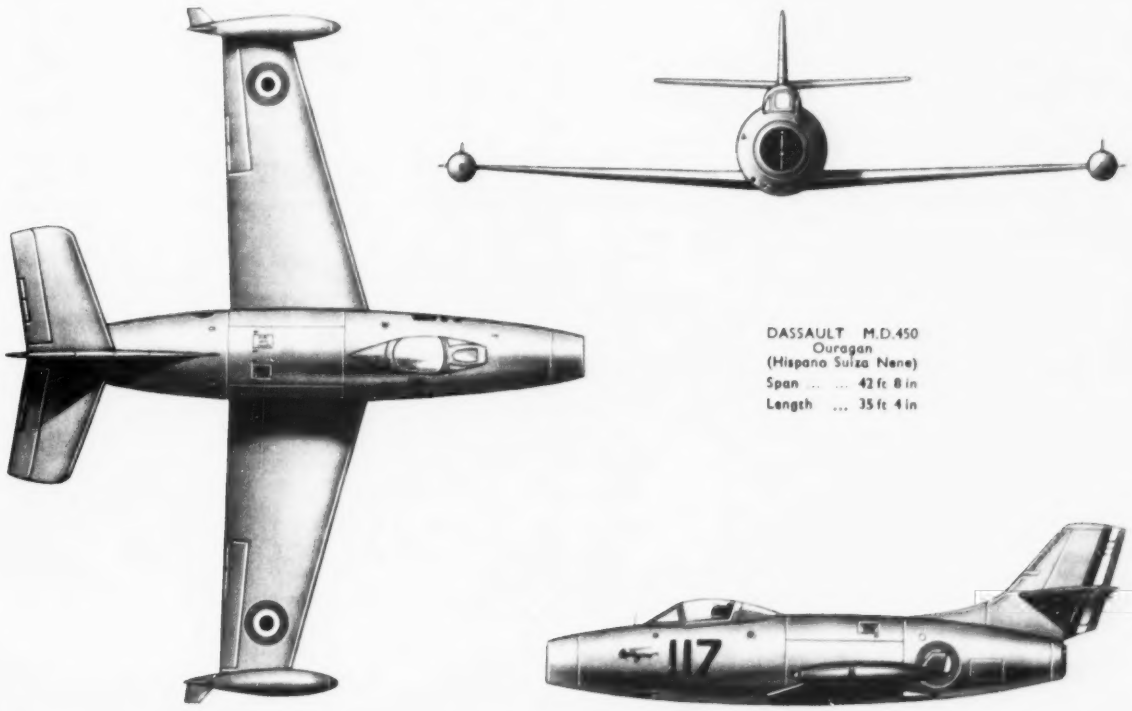
Marcel Dassault Mystère. It may be recalled that Charles Monier, the well-known French test-pilot, was killed recently while flying one of the Mystère prototypes. Enquiries have shown that, while the aircraft was at a height too low to permit ejection, one tip-tank broke away and hit the tail. The Mystère is unique among swept-wing aircraft in having tip-tanks. The Sabre carries extra fuel in braced underwing tanks mounted on pylons, and the Hunter will—according to American reports—have Mosquito-type underwing tanks mounted flat against the wing surface.

Canada

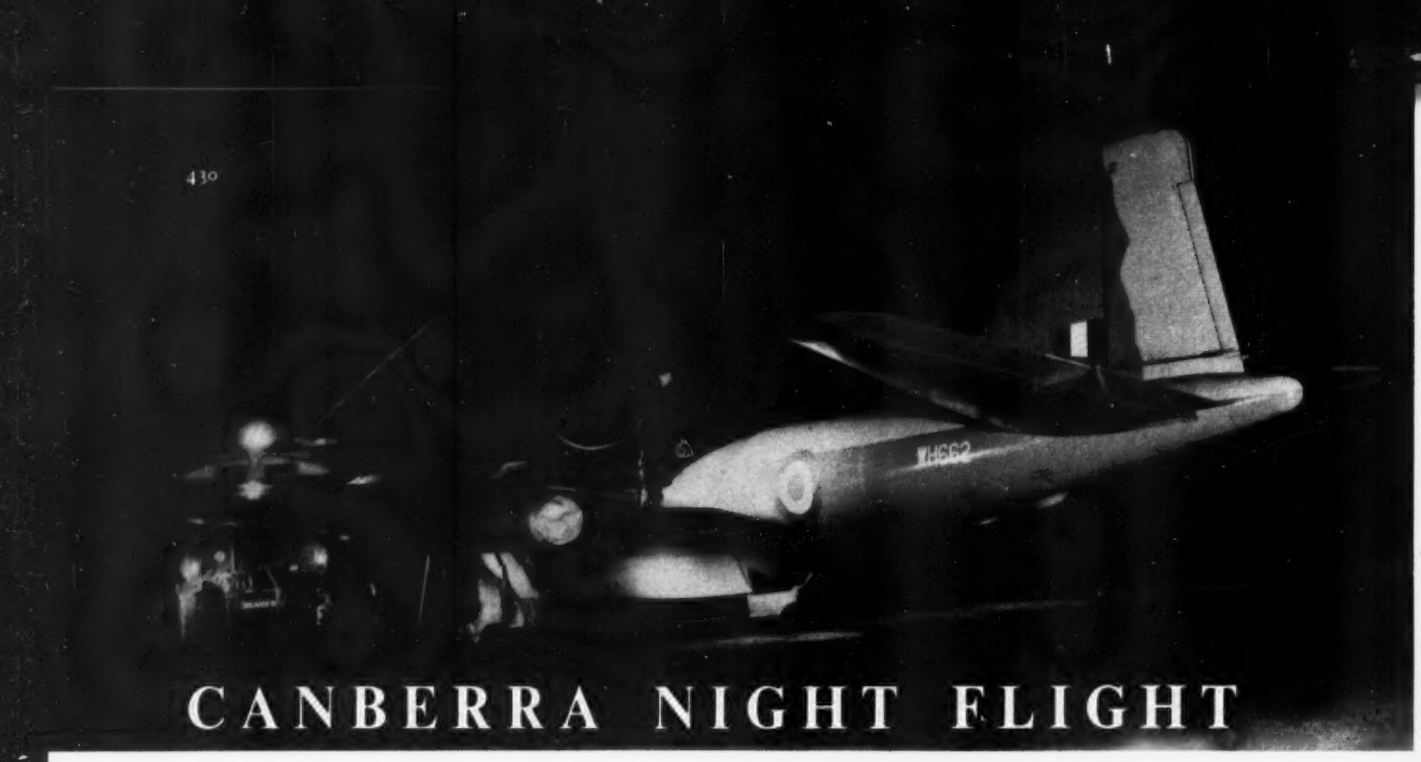
Avro Delta Fighter. Such an aircraft would appear logical, in view of the delta experience of the British Avro company. It appears that a project for a "1,300 m.p.h. turbojet delta fighter" has been under examination by Avro Canada for some months, but that the Canadian government is unwilling to provide sufficient capital for its development. *Aviation Week* has it that $105 million is needed; this should not be an underestimate. In addition, the "flying saucer" mentioned on this page some weeks ago has figured in further reports, which state that it is a vertical take-off fighter of roughly circular plan form, and that a wooden mock-up has been built for "operational evaluation."

Russia

Tu-4 development. As is well known, the B-29 Superfortress—several of which were acquired by Russia in 1945—was placed in production in Russia in 1947. It is now thought that the original ASh-90 engines (copies of the Wright R-3350) have been replaced, in the latest types of Tu-4, by M-300s of some 3,000 h.p. each. At the same time, additional tankage and equipment have been added to bring the standard Russian piston-engined bomber into the B-50 class.



DASSAULT M.D.450
Ouragan
(Hispano Suiza Nene)
Span ... ... 42 ft 8 in
Length ... 35 ft 4 in



CANBERRA NIGHT FLIGHT

TO BREMEN AND BACK ON EXERCISE "JUNGLE KING"

BY **ROBERT J. BLACKBURN**

The complement of WD 998: navigator (F/O. Hancock), passenger, and pilot (Sgt. Neate).

MEMORIES of a previous visit to Binbrook were revived when, as the R.A.F. truck from Grimsby drove up to the station guardroom, I glimpsed against the skyline the gaunt and angular silhouette of a Lincoln. The Canberras, sleek and low-lying, were not to be seen. But, so far as this station is concerned, the veteran Avro bombers have served their turn. During Exercise "Jungle King" they stood forgotten, disused and awaiting disposal, while the airfield echoed day and night to the thunder and whistle of a new brood of jet bombers.

On arrival at Binbrook, the first step was to find out when the promised and eagerly accepted trip in a Canberra would take place. Nobody knew: under war-time conditions, admirably simulated during the exercise, the operational order reaches the station only a few hours before the attack. Speculation was rife during the interval, which provided a welcome opportunity to meet the station commander, G/C. N. C. Hyde, and many of his squadron commanders, pilots and navigators. Visitors could hardly have received a more hospitable or enthusiastic welcome at Binbrook if they had been a body of experienced aircrew, rather than lay passengers of uncertain fitness for the morrow's task. Practically every R.A.F. station is remotely situated, and Binbrook is more so than most. This apparent disadvantage is offset by the "Village Inn," a unique feature contributed to the mess by R.A.A.F. officers who were based there during the war.

In these cheerful surroundings I was re-introduced to the Lincoln pilot, formerly of No. 9 Squadron, with whom I had flown —on Exercise "Verity"—nearly four years ago. In the interim, I learned, he had been promoted, converted to Canberras and (only the previous day) had become the father of a baby girl. Accordingly, we celebrated—but in moderation, so that there was no undue difficulty in rising early next morning to watch a "large force of Canberras" take-off in the grey dawn for a high-altitude attack on Germany.

From the chilly airfield we made our way, *via* breakfast, to the station sick-quarters and Phase 1 of our indoctrination to modern bombing technique. F/O. Dilley, the medical officer in charge, made a check of weight and height, ears, lungs and blood pressure and found us fit to proceed to the clothing store. Here we drew a selection of new and expensive-looking equipment: helmet, mask, pressure waistcoat, flying overalls, gauntlets, suede boots and long woollen stockings.

Unfamiliar items are, of course, the pressure-fed mask and waistcoat—equipment necessitated by the possibility of pressure-cabin failure at altitudes above 40,000ft. The mask has a sponge-rubber lining which must mould tightly around the facial contours without any leak; like other visitors, I tried on several before getting a perfect fit. With the three-position flow-valve on the front of the mask turned to "high" (indicating that oxygen is being fed in at maximum pressure), one must be able to exhale vigorously without any breath escaping from the edges of the mask; the only vent permissible is a spring-loaded non-return valve. Under this condition the waistcoat is inflated by back-pressure through a connecting-point on the oxygen hose, so that in thin air, when the chest muscles are ineffective, the wearer's breath is forcibly exhausted from his lungs. The waistcoat, which must also fit snugly, has a zip fastener in front and lacing behind. It is worn outside the flying overall and inside the parachute harness and mae west. Neither goggles nor visors were issued, and one pilot showed us a normal tennis eyeshield which he wears at high altitude in preference to the large and heavy visor introduced experimentally last year.

Kitted-up, our small party was next sealed into the decompression chamber to enable the M.O. to spot anyone unduly susceptible to rapid changes in altitude. Air was extracted from the chamber until the density within was equivalent to 35,000ft; the doctor and his orderly observed through portholes in the grey cylinder, murmuring encouragement over the intercom. A five-minute "descent" to normal atmospheric pressure produced no unpleasant sensations, and the victims were set free.

Meanwhile, a "B form," calling for an attack that evening, had arrived from Group H.Q., and the general briefing of crews was about to begin. Passengers had been allocated to squadrons, and I learned that I was again to fly with No. 9. The commanding officer, S/L. J. C. M. Mountford, A.F.C., added a sweater, mae west and woollen mittens to my equipment, and we joined the

Illustrating round-the-clock effort by Canberra ground crews, these night and day scenes from Binbrook show refuelling (left) and servicing of electrical equipment (right). Pictured below in the de-briefing room after a sortie are (left to right): A.V-M. S. O. Bufton, A.O.A. Bomber Command; S/L. J. Mountford, O.C. No. 9 Sqn; A.V-M. Sir Dermot Boyle, A.O.C. No. 1 Group (who takes up his new appointment as A.O.C.-in-C., Fighter Command, on April 5th); and G/C. N. C. Hyde, O.C. Binbrook.

crew—Sgt. Plt. Kenneth Neate and F/O. Kenneth Hancock (navigator)—in the briefing-room.

Maps and flight-plans, issued 30 minutes earlier at the specialist briefing, were already spread out on the briefing-room tables. A more colourful and large-scale impression was given by the brightly lit wall-map, showing the outward and return paths to be taken between Binbrook and North Germany. W/C. Connolly, Binbrook's wing commander flying, who wears the Pathfinder badge above the ribbons of his D.F.C. and A.F.M., called for attention and began the briefing.

The primary purpose of the operation, he explained, was to reduce the enemy's tactical air strength. Intelligence reports showed that their 774th Fighter-bomber Regiment, with a strength of 36 aircraft, was based at Bremen Airfield: "Hence we are going tonight to Bremen." Washingtons and Lincolns would be bombing night-fighter fields at Bückeburg and Gütersloh. The Canberras' attack would take the form of a shallow penetration routed to avoid the enemy's defences, but there was a possibility of interception by night fighters.

One by one, briefing officers took their place on the rostrum to issue information, instructions and advice on navigation, radar, bombing, signals, intelligence, meteorology and air-traffic control.

Speeches were quick and to the point, with crisp interpolations from the wing commander flying—"This is our training for war . . . as in war, the only reason for failure to put down your bomb is something which endangers the aircraft or the crew . . . Diversion will be the penalty for unnecessary R/T. natter . . . Stay in the groove . . ." The met. man evoked a customary laugh by pointing out that the line on his chart was not a front but a crack in the lantern-slide. His prediction (which, incidentally, proved to be most accurate) was that the target would be free of cloud and with two miles visibility, but that a low layer of stratus, 1,500ft thick, would cover Britain and much of the North Sea. The weather would not improve, and the chances of diversion were 45 to 55. Valley, Kinloss and Prestwick were named as the most likely alternative airfields.

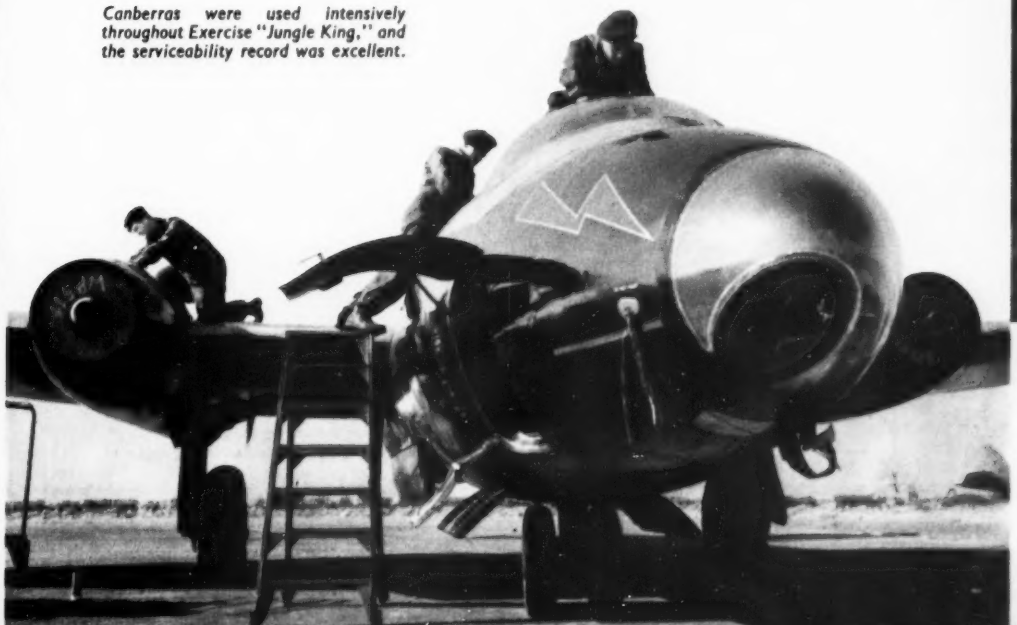
Briefing was completed with a few words on the undesirability of going the wrong way (this accompanied by a glance at the East German end of the wall-map), as a result of "compass trouble or finger trouble."

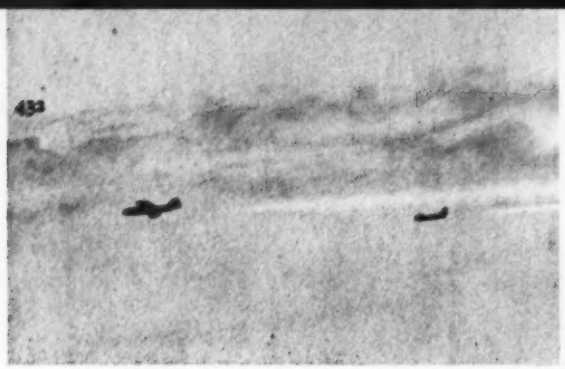
Very soon crews were disembarking from cars, trucks and Land-rovers at various dispersal points, exchanging final words with ground staff and climbing aboard their aircraft. The Canberras' colour schemes—some blue, with grey and green upper surfaces, others black and grey, or, on the latest, all silver—varied according to the camouflage theory in vogue at the time of their construction. "Odd" tip-tanks and rudders occasionally added further variety. But in the greyness of near-twilight it was form rather than colour which caught the eye and imagination—the effect of sleek and powerful shapes crouched on every circle of concrete.

Squadron letters are carried no longer, and our blue Canberra B.2—sans tip-tanks—was identified only by the serial number

(Right) Inserting a cartridge into the highly effective Rolls-Royce/B.T.H. starter, which is housed in the Avon "spinner."

Canberras were used intensively throughout Exercise "Jungle King," and the serviceability record was excellent.





Canberras eluded interception on almost every occasion, even though standing patrols were often maintained by day. Here is one of the rare encounters with opposition (by a Sabre).

Silver finish is standard on new Canberras, although many blue or black machines are in service. This later model carries the new large serial number on wings and fuselage.

CANBERRA NIGHT FLIGHT...

WD 998. Twenty minutes before take-off is normally an ample time for pre-flight preparations, but we entered a little earlier (for passenger-briefing purposes). Sole admittance to the crew-section is by the pressure-sealed door on the right-hand side of the nose; parallel to the door, but on the left, is the pilot's ejector-seat. Similar seats, placed side-by-side, are provided aft for the two navigators. F/O. Hancock took up his position on the left and guided my blind approach (tail-first) into the right-hand position. While Sgt. Neate began his cockpit checks I attached dinghy to mae west, buckled up the parachute and seat harness and plugged in intercom. and oxygen leads.

An emergency oxygen-point is provided to assure supply in the event of ejection. If it becomes necessary to abandon ship, the pilot's canopy and navigators' hatch are jettisoned by means of explosive bolts. The Martin-Baker seats have the usual footrests, and are triggered by a D-ring attached to the face-blind; the safety device is a pin which is placed behind the occupant's head and carries a large medal painted red as a warning.

Rather uneasy ponderings on the subject of emergency departure from high-speed aircraft were interrupted by the cough of a cartridge-starter, and within seconds both Avons were running smoothly at idling r.p.m. The engines are placed further back than on the Meteor, and the Canberra is therefore quieter; normal conversation was possible at this point. As we taxied out for take-off the navigator's R/T. failed, and he plugged into another socket. This was the only mechanical snag encountered.

From the right-hand rear seat visibility was practically non-existent. The two navigators' windows in the roof were curtained, and my only glimpses of the outer world were through corners of the small window on the left and the canopy ahead. At 1759 hr, precisely on schedule, the Canberra accelerated down the runway. By 1800 hr the cockpit had grown brighter, indicating that we were rapidly leaving behind us not only the airfield but the cloud layer which covered it. Apart from a surprisingly gentle pressure on the back, there was no other sensation. As we sped to our operating height, Sgt. Neate invited me forward to the "rumble" seat, which folds down to form a small bridge between the right-hand fuselage wall and the pilot's seat. Away in front of WD 998 two brown contrails revealed companions from Binbrook *en route* for Bremen. We reached our cruising height of some eight miles in less time than it would take to smoke a cigarette.

At altitude, the Canberra is rock-steady and only the hiss of air betrays motion through the rarefied atmosphere. We cruised at a constant Mach reading of 0.7 plus, which, allowing for height and an outside air temperature of −62 deg C, meant over 500 m.p.h. Scanned through the clear dome of the canopy, the heavens presented an almost incredible sight—a combination of night and day. Behind, to the west, the departing sun left an orange-crimson horizon; the sky ascended and curved through pale spectrum-colours to a delicate blue above. As the arc continued, the shade deepened—through a purple mist of near-solid intensity to the night which had already fallen on the Continent ahead. Moon and stars gleamed with varying brilliance. Such sights, however inspiring, are but a passing distraction to the crew, who must devote themselves almost entirely to their instruments.

After an intentional diversion from track, in order to lose a few minutes in hand, we were ready to begin our bombing-run on Bremen. Only 45 minutes had passed since take-off and already patches of diffused light showed the positions of towns and cities on the hazy land-mass beneath.

As the target grew near I spotted another aircraft, leaving a just-visible contrail which revealed its path of approach—from "one o'clock low." How low it was impossible to judge, and although there was a momentary glint of moonlight on metal the whole incident was too brief for even an attempt at identification. The closing speed of the two machines must have been at least 1,000 m.p.h.

Absence of cloud in the target area did not affect our instructions to make a simulated blind-bombing attack. The crew, concentrating on their instruments to ensure perfect accuracy, could hardly spare a second to glance at the ground; the clear-vision bombing position in the nose remained unoccupied and F/O. Hancock continued to direct the pilot from the navigator-plotter's seat. Normally the run over the target is controlled by a third crew-member—the observer, who assists with *en route* navigation. On this occasion the third man, if not exactly a hindrance, was little help, but the single navigator coped well with his double duty. At the calculated moment of bomb-burst, an aft-mounted vertical camera was exposed for two seconds, enabling assessment of the attack to be made on our return.

The Canberra's power and handling qualities at height were illustrated when, about 50 minutes after take-off, Sgt. Neate turned steeply away from Bremen and headed for base. Having disposed of our "bomb load," we were able to decrease further the chances of interception by adding 5,000ft to our cruising height. Despite the very impressive figure already shown on the altimeter, the climb was effortless and very quick indeed.

By now, condensed moisture in the cabin had frozen and formed a glaze on every metal surface, but the interior remained warm. Air tapped from the Avon compressors kept the cabin "altitude" below 25,000ft. I had been warned that my feet, knees and hands might become cold after the first hour or so, but, on this flight at least, cabin conditions were certainly equal to those found in the average airliner—and better from the viewpoints of noise and vibration.

WD 998 maintained an even higher air-speed than is usual on such operations, and we found ourselves several minutes ahead of schedule. In order to arrive on time at the concentration point 100 miles from base we turned south and flew parallel with the Dutch coast for a while before turning north to resume track. Listening-out for a possible order to divert, we turned on navigation lights and began a rapid descent 50 miles from base to the holding altitude—30,000ft. To demonstrate the effects of compressibility—a gentle buffeting without trim-change—Sgt. Neate began the descent at increased Mach number. Slight shuddering set in rather earlier than was expected, giving the probable explanation for our extra-high cruising speed—a "slow" Mach-meter. Earlier, the possibility that we had encountered a jet stream had been raised but rejected, since we were gaining time in both outward and return directions. Dive-brakes were extended, steepening the dive, and we continued to shed height. No ear-popping was experienced at any time, despite the high rate of descent; neither did I sense any unpleasant g effects. It was possible to perch comfortably on the rumble-seat without harness.

We pulled out over the cloud-blanket covering Spurn Head, the Humber and Grimsby, and flew on at 30,000ft beyond Binbrook to Lincoln. Above us were contrails, like chalk marks on black velvet, marking the homeward path of other Binbrook Canberras. A 180 deg turn brought us back to base. Sgt. Neate called up the tower with "Pearly One Nine overhead"—our call-sign and code-number. Permission to descend and turn into the G.C.A. pattern was refused, since other aircraft were just taking their place in this part of the landing queue. We orbited once and again called "overhead"; this time our Canberra was accepted and we began a 5,000ft/min descent at a specified Mach number, turning on to course for the airfield at the appointed height of 17,000ft.

Cloud-base at Binbrook was only 300-400ft, with 2,000 yd visibility, and the pilot prepared for a ground-controlled approach. As the Canberra scudded into cloud a few miles from the runway, with dive-brakes extended to reduce speed, the reassuring voice of the controller came through on our new R/T. frequency "... Pearly One Nine—talkdown ... you are number one to land on this approach ... check wheels and flaps down ... descend to two point one at five hundred feet per minute ... turn five degrees right ..." At the lower height the frost melted, producing a cascade of droplets on the navigator's table and a mist on the canopy. Sgt. Neate wiped his windscreen clear with a rapid sweep of the arm and concentrated on the controller's instruc-

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tions: "Two miles to touch-down, heading good . . . fifty feet below the glide-path . . . heading still good . . . on the glide-path . . . quarter of a mile to go . . . look for the runway and land . . ." The curtain of cloud parted to reveal twin rows of amber lights, and within ten seconds—at 2008 hr, just 2 hr 9 min after take-off—we had touched down. A comparable Lancaster sortie to the same objective would have taken at least 4½ hr.

Meanwhile, several of the other Binbrook Canberras, those flown by pilots with "White-card" instrument-ratings—were being diverted to other airfields with better visibility and higher cloud-base. These aircraft carried tip-tanks, and consequently had a better margin of endurance; some of the Canberras had not yet been so equipped, and the longer-range aircraft were normally reserved for less experienced pilots.

De-briefing began with a quiz from the intelligence officer. Sgt. Neate's reply to his first question summed up our flight in a nutshell: "Yes, it was a successful mission."

This was an encouraging glimpse of one of the many efficient and large-scale operations flown by Bomber Command's new Canberra squadrons. Both crews and aircraft stood up well to an exacting test: at Binbrook, where every force took off at full strength without a single "early return," there were only one or two cases of unserviceability. In his review of "Jungle King," Air Chief Marshal Sir Hugh Lloyd stated that there had not been a single engine-failure among Canberras taking part.

During "Jungle King," Canberras made a number of live-bombing attacks on the Nordhorn range with 25 lb practice missiles.

AUTOMATIC EJECTION-SEATS

Mr. James Martin gives the Background to a High-altitude Test

LAST week we published a note on the remarkable high-altitude ejection-seat test carried out (from Chalgrove Airfield, Oxfordshire on March 17th) by Mr. B. Lynch, B.E.M., of the Martin-Baker Aircraft Co., Ltd.; and now we are able to quote a letter from Mr. James Martin, O.B.E., F.R.Ae.S., which gives further details of the ejection and, incidentally, supplements the report (*Flight*, November 14th, 1952) of a lecture, on the development of the seat, that he delivered in America last year.

Since 1946 (writes Mr. Martin) our ejection seat has been standard equipment for the Royal Air Force and Royal Navy. This seat has been manually operated: by that I mean that when the pilot wishes to eject himself he must first jettison the hood, then pull the face-screen over his face, and then be shot out. A moment later the drogue gun is fired by means of a static line. The energy of the bullet from the gun pulls out the drogue parachute; the function of this parachute is to stabilize the seat and keep it from cartwheeling. With the manually operated seat the pilot then has to undo his harness, fall out of the seat and use his parachute in the normal way.

Bernard Lynch, photographed shortly before the test described here.

There are certain disadvantages with this manually operated type. Take the low-altitude case: with the automatic seat we have done a large number of ejections as low as 500ft and have had 250ft to spare when the main canopy has developed. With the manually operated seat we would estimate that it would require at least 1,500ft to give a reasonable margin of time, and, of course, so much must depend on the individual. So the automatic seat has enormous advantages; if a man is shot out at 500ft in level flight at the highest possible speed at which a modern aircraft can fly, he is automatically lifted out of his seat five seconds later.

Take the high-altitude case: there has always been a theory that the seat might spin axially, due to the rate of descent from such a high altitude. We carried out a large number of tests with dummies from 33,000ft and the seat fell through space on the drogue parachute only, without spinning; the time mechanism, which is barostat-controlled, releases the drogue from the main seat, undoes the pilot's harness and extracts the canopy from its pack; the pilot is then lifted out of the seat. If for any reason the pilot were unconscious it would all happen automatically without any action being required from him after actual ejection from the aircraft. Incidentally, emergency oxygen is carried and is turned on immediately on ejection; it is sufficient to last the pilot during his free fall. We recently decided to do a live test with our parachutist, Mr. B. Lynch, B.E.M. Prior to the test he was medically examined at the Institute of Aviation Medicine by G/C. Stewart and was found to be medically fit; he was also tested in the decompression chamber and his reactions seemed satisfactory. Incidentally, he weighs sixteen stone, so is a bit heavy for parachuting.

On March 17th the test was carried out from our old Meteor 3 which was converted by us six years ago into a two-seater and has since been used for our ejection tests. The machine climbed to approximately 29,000ft and Lynch ejected himself. It was possible, with special binoculars, to follow the seat down, and it only turned round very slowly during the descent. Lynch felt no discomfort from the cold or from lack of oxygen.

We have been working on automatic ejection seats since 1947 and have done a very large number of tests with various arrangements and schemes. The seat that was tested out on March 17th was a standard Mk 1 seat with the addition of the various bits and pieces to convert it from manual to fully automatic operation. The components for these conversion sets are now going into intensive production and all seats for the Royal Air Force and Royal Navy should have these fittings supplied to them within the next few months.

We have also designed and developed a new telescopic jack suitable for bombers; it gives an ejection velocity of 80 ft/sec, so that there is plenty of clearance over the fin. We have also designed a new lightweight automatic seat, the prototype of which will soon be completed; this will give an ejection velocity of 60 ft/sec; the bottom of the seat pan practically touches the floor. This seat will have combined parachute and seat harness.

Is the Aircraft Carrier Obsolete?

An M.P. Renews an Old Controversy

IN reporting, last week, the "aviation" passages in the Naval Estimates speech made in the House of Commons by the First Lord of the Admiralty, we mentioned that one Member, in the debate which followed, questioned the value of the aircraft carrier in modern war; and we promised to quote some of his remarks.

The Member in question was Dr. Reginald Bennett (Con., Gosport and Fareham), and he began by saying that he spoke as one who "had some connection with the Fleet Air Arm for a number of years."

It was his contention that the Navy was "still about a generation out of date"—a generation among aircraft being some seven years—compared with the flying forces ashore. The aircraft inevitably were of limited performance because of the tasks they had to do, particularly those of getting on to the small deck of a carrier and getting off it, and with a remarkable collection of odds and ends; no angled deck or steam catapult would suffice to allow ship-borne aircraft to have performances comparable with those of aircraft ashore. Therefore, at all times ship-borne aircraft would tend to be at a disadvantage compared with aircraft which they had to meet—unless they, too, were ship-borne.

Aircraft carriers had three functions: anti-submarine and anti-surface-vessel search; strike; and fighter defence against air attack. He believed that the use of carriers for the first two jobs was now entirely mistaken. It was not yet entirely mistaken for the third but, taken by and large, the use of aircraft carriers in large numbers ran up the most colossal aggregate of risk. It was the most expensive possible way of operating aircraft over the sea. A carrier was very nearly as costly a loss if sunk as the whole convoy which it was trying to defend. Secondly, the escorts needed by a carrier were as numerous as the convoy itself needed.

His criticism could be summed up in a familiar, if somewhat paraphrased saying: "It is not so much having all our eggs in one basket as having all our baskets in one egg." The first job for carrier aircraft was supposed to be anti-submarine and surface-vessel search. He believed that with the aircraft even now operated by the NATO Powers the middle of the Atlantic could be adequately covered by shore-based types. The mantle of security made calculation difficult, but he believed that ordinary propeller-driven or turboprop aircraft operating from shore could do the job of the carrier-borne anti-submarine aircraft, involving not more than the use of two or three land-based aircraft as against one carrier-borne.

Assuming that ratio as not unreasonable, he suggested that the total numbers of squadrons which must be maintained to keep the equivalent number of aircraft at sea, together with the amount of fuel, would cost only a small fraction of the cost of the sea-borne aircraft, the fuel, the carrier, the carrier's crew and the escort.

As far as strike aircraft were concerned, standing patrols of shore-based aircraft flying on partial power could do the job just as readily and could be on call permanently without having to have an aircraft carrier present in the midst of all the danger.

Of the fighter purpose, Dr. Bennett supported the views of an earlier speaker (Mr. R. Allan, Paddington, South) in the debate; as he had said, there was a great deal of point in the evolution of a light fighter, ship-borne and catapulted, but—unlike those used in the Western Approaches during a sticky period of the last war—recoverable. They could be facultative seaplanes; they could land on water or, with a skid, on shore; and the pilots would be recoverable, not written off, every time one came down on the sea. Merchant ships—particularly tankers, with all the space they had on top—might have an arrangement for catapulting off fighters, such as the Member for Woking (Mr. Watkinson) and himself had accompanied from time to time in the last struggle.

He did not believe that the enemy aircraft which would be used for reconnaissance and convoy spotting in the Western Approaches would be fast, high-performance jet aircraft. Such types could not operate at low altitudes or have long ranges. The aircraft that could carry out reconnaissance over the Western Ocean would be propeller- or turboprop-driven so as to be able to fly low and slowly, and, therefore, they did not need the hottest land-based fighters to deal with them. What was wanted was a fighter which could carry a few air-to-air missiles or even one which could direct ship-to-air missiles. But even before guided missiles—about which none of them knew anything—came on the scene, the type of fighter necessary to shoot down a "deep-sea" aircraft need be only of a moderate performance compared with its colleagues on shore.

Dr. Bennett also referred to helicopters and flying-boats. He said that although the Navy had some helicopters it had not nearly enough; it would need complete squadrons. It had one squadron operating now, and it had been his privilege to talk with some of the officers of that squadron when it returned from the floods in Holland recently: helicopters fitted to take two people in the back seats had carried seven, and one helicopter alone had rescued between one hundred and two hundred people.

These helicopters were an infinitely flexible weapon and a flexible "utility" to have around the Navy. We should not only have plenty in operation, but we should have R.N.V.R. squadrons equipped with them. We should start training helicopter pilots without first giving them fixed-wing training, which was a total loss for those who were to fly with rotating wings.

Although on previous occasions the Air Ministry might have obstructed the Navy on the question of operating flying-boats there was now no reason why they should do so. Flying-boats could be proved very useful, if the Navy wished to use them, for communications, patrols, landing operations or as part of the Fleet train. This was the Navy's best chance. They had missed the opportunity of getting Coastal Command when the Air Ministry were not interested in it, but they now had a chance of operating flying-boats. They should look at this question and make the most of the opportunity, because now was the time for them to assert themselves in the air, even though they had failed to do so hitherto.

MORE ABOUT THE AIR ESTIMATES

FURTHER attention was given by the House of Commons to the Air Estimates when, on March 19th, they were considered on report stage. The gist of remarks then made was reflected in the summing up by Mr. George Ward, Under-Secretary of Air.

He first dealt with a comment by Mr. Arthur Henderson (Lab., Rowley Regis and Tipton) on a reported statement by C-in-C. Bomber Command that the development of jet aircraft, airframes, and engines had run clear away from the development inside the aircraft. Mr. Ward recalled that he had made a similar observation when introducing the Estimates. He reaffirmed that there was continually a race between the new developments in aircraft and their performances, and trying to keep up with the electronics. For that reason the electronics industry had had a heavy load imposed upon it. There might be some light production difficulties, as were present in most industries—and in other countries—under a heavy programme of rearmament, but he thought it was quite safe to say that as far as technical know-how was concerned, this country was still second to none.

In answer to questions about the Princess flying-boat, he said the main points to remember were that there was a limited amount of money available for spending on all forms of defence, and to use the Princess in a transport role would need very expensive provision in the way of staging posts, terminal buildings, marine craft and so on. The provision of all these things was likely to make the Princess uneconomical for this purpose in peace. Another point to remember was that the Valiant, for which a transport prototype had been ordered, would have a tremendous performance and would be far more efficient and economical to operate in a transport role than the Princess flying-boat was likely to be.

Mr. Ward denied a complaint by Mr. Frank Beswick (Lab., Uxbridge) that his remarks seemed to imply that the whole conception of using the Princess flying-boat when the engines were available had now been given up. (Later, on March 23rd, the Minister of Supply, Mr. Duncan Sandys, declared that it would be a "tragedy" if all the work that had gone into the Princess project came to nothing.)

Dealing with the Provost-Vampire training sequence, Mr. Ward said the first course of Provosts ought to start in autumn, and the training on the Vampire would start early 1954, as soon as the first Provost-trained pupils came along. The limiting factor was the production of Provosts.

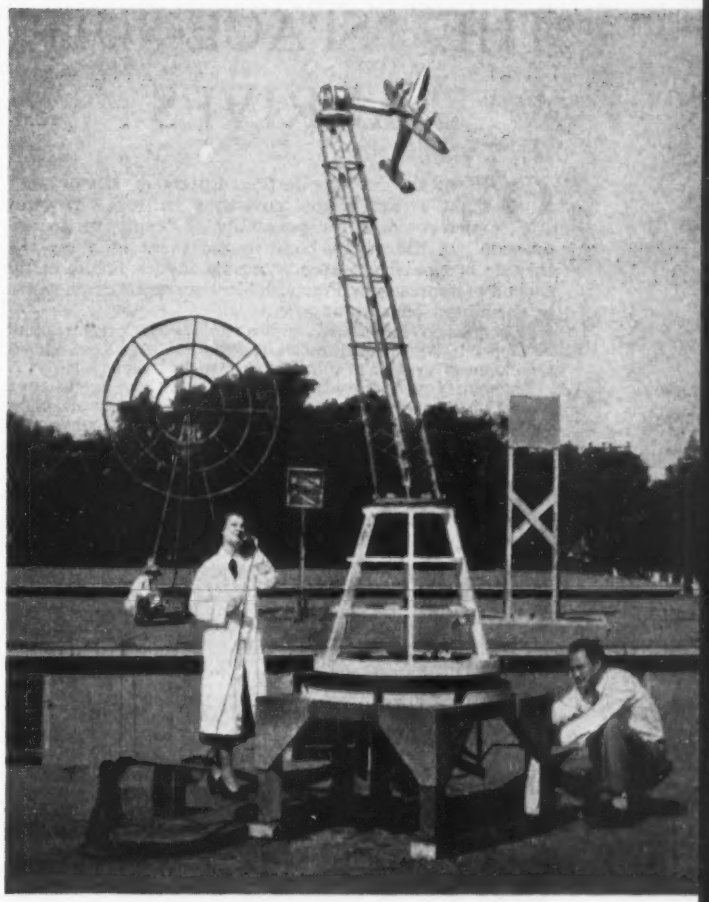
Mr. Ward then turned to further criticisms about the decision to close down more flying schools and said that, in this connection, it must not be forgotten that within the Regular Air Force there were a number of young G.D. pilots fully trained who in the normal course happened to be doing non-operational duties. They could be replaced quickly by officers from the administrative and special duties branches and could go into the front line at once. Behind them were a number of reservists not long out of the Service, and not far removed from recent operational flying. They too must be given refresher flying on jets under Service arrangements to meet immediate requirements on mobilization. The number of reservists to be kept in training, and the type of training given must be related to our wartime requirements. At present some 250 pilots and 300 other aircrew were being trained at Service stations. These men had, at their own request, returned to their own stations for their continuous training. During the next 12 months training on Chipmunks and Ansons would continue at Reserve flying schools, and some 3,000 aircrew would be called up for this purpose.

ANTENNA RESEARCH

WITH the improved performance of present-day aircraft has come a growing preference for suppressed aerials, in place of those externally mounted, to serve the complex aircraft-radio systems. An extensive programme of research into the design and construction of the new-type aerials has recently been commenced at the Aircraft Radio Systems Laboratory of the Stanford Research Institute, California, in co-operation with several west-coast aircraft firms.

Scale models of aircraft have been widely employed in the laboratory, together with operating wave-lengths correspondingly scaled down, in the study of antenna radiation patterns, the distribution of induced skin radio-frequency currents, and electrical resonance effects. Another significant phase of the work at present continuing is concerned with the use of a single antenna structure for a number of radio equipment units, and is intended to reduce the modifications required on aircraft already in production or operation. One aspect of this study has led to the development of an automatic antenna matching unit; and filter networks, to reduce interaction between units are among several other items being developed.

Two C-54 "Flying Laboratories" are operated by the Institute, in co-operation with the U.S.A.F., to study general flight problems of long-range communication and navigation systems. One project was the comparison of the efficiency of three types of aerials for long-range air-to-ground communications; transmissions from the U.S.A.F. Wright-Patterson Base in Ohio were picked up by the aircraft, some 2,000 miles away over San Francisco Bay, and tape-recorded for later evaluation and comparison at the Institute. In addition to the technical staff employed on the evaluation and application tests of new equipment, a number of mathematical physicists are employed in the Aircraft Radio Systems Laboratory on the more fundamental branches of electronic research.



On the model test range on the roof of the Aircraft Radio Systems laboratory, a scale Constellation, fitted with experimental aerial, is tested. Rotation of the mounting column enables radiation patterns to be studied.

THE KEY TO INCREASED PRODUCTION

WE have made references, during past months, to the intention to form an organization concerned with furthering the science of materials handling. These plans have now matured, and on March 19th the Institute of Materials Handling held its inaugural meeting, at the Trocadero Restaurant, London.

Numerous enquiries for membership have been received from executives of many industries, including the aircraft industry. It was the purpose of the meeting to hear the report of the provisional council of management and to approve the rules of the Institute.

At the inaugural dinner of the Institute of Materials Handling: (Left to right) Mr. W. Ralph Purnell, immediate past president of the Mechanical Handling Engineers' Association; Mr. S. Hattan, member of the council; and Mr. C. E. Wallis, chairman and managing director of Iliffe and Sons, Ltd., the publishers of "Flight."

The principal speaker at the dinner which followed the meeting was Lord Llewellin, C.B.E., M.C., T.D., who proposed the toast of "The Institution." Speaking as an ex-Minister of Food, he reminded the audience that we could only support about one-third of our population so far as food is concerned, and we had to sell our products to support the entire nation of 50 million people. Speaking as a member of the Ports Efficiency Committee, he stressed the need for overcoming reluctance to use labour-saving appliances: the most modern equipment was useless if it was not properly used.

Replying for the Institute, E. G. Whitaker (the chairman) said that we are forced by economic circumstances to increase production beyond any measure to which we were accustomed to. The potentially largest field of development was in materials handling, but research was essential to find the most suitable methods, and the Institute had an important part to play in this respect. Sections had already been established in London, Birmingham and Manchester, and a Glasgow centre was about to be formed. "At a conservative estimate about £50 million could be saved by British industry annually by developing techniques of materials handling," said Mr. Whitaker.

The interest shown by the Services in the aims of the Institution is evident from the presence at the inaugural dinner of Admiral Sir Michael M. Denny, K.C.B., C.B.E., D.S.O., Third Sea Lord and Controller of the Navy; Major-General H. F. S. King, C.B., C.B.E., Inspector of the Royal Army Ordnance Corps; and A.V-M. L. J. V. Bates, C.B., C.B.E., Director-General of Equipment, Air Ministry.

The offices of the Institute of Materials Handling are at 20-21 Took's Court, Cursitor Street, London, E.C.4.

THE "SPACE-SUIT" ARRIVES

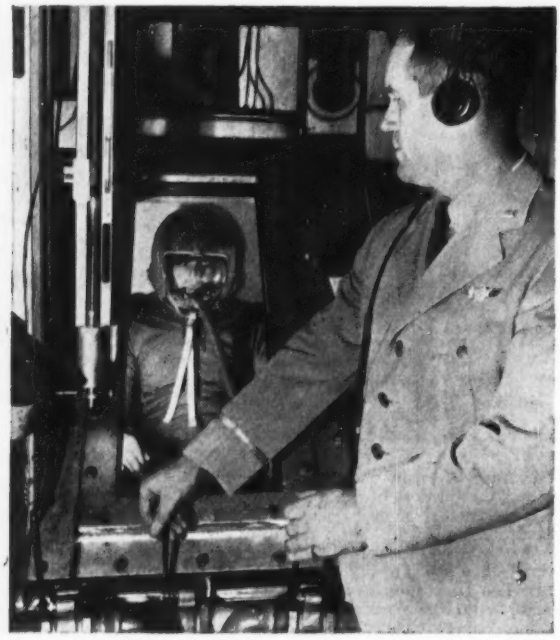
ONE of the less comforting aspects of stratospheric flight at the heights envisaged for rocket-powered intercepters is the possibility of "explosive decompression" of the pilot's body in the event of a canopy-fracture or similar occurrence causing sudden failure of the cockpit pressurization. Practically instantaneous death would be the almost certain outcome.

Illustrated on this page are various views of the "pressure unit" developed by the medical specialists of the U.S. Air Research and Development Command to guard against the danger.

Preliminary work is said to have started as long ago as 1943, when a small group at the University of Southern California, under the direction of Dr. J. P. Henry, investigated the physiology involved. In 1946, the University of Southern California delivered a prototype suit to the U.S. Aero Medical Laboratory. Dr. Henry joined the Aero Medical Laboratory staff at that time, and the Air Force began its intensive development of the suit.

The design was complicated by the simple human factor of the varying size and shapes of flying personnel: the suit not only had to be adaptable to this basic requirement, but also had to be amenable to production.

The result of six years' development, this American high-altitude suit incorporates an automatic anti-g device. Inflation tubes are seen along the outsides of the pilots' arms and legs.



(Left) For test and experience: At the U.S.A.F. aeromedical laboratory Capt. T. V. Kennedy, who is a pilot and flight surgeon, gives a pilot experience in the use of the suit in a high-altitude chamber. Pressure conditions at 50,000ft can be simulated.

The suit is worn uninflated, but inflates automatically should cabin pressure fail. The inflated suit and helmet then "supercharge" the wearer's lungs with high-pressure oxygen and simultaneously apply counter-pressure to the body's surface.

As will be seen, the equipment bears some resemblance to the science-fiction conception of a "space suit". It opens at the back, and is closed there by zip fasteners. Lacing down the sides, arms and legs enables the material to be pulled to a tight fit. The equipment combines suit, helmet, oxygen mask, earphones, microphone, goggles and "bale-out" oxygen-bottle. The transparent plastic face-plate has a grid of fine defroster heating-wires sandwiched into it; the terminals are visible in the photographs as two spots just to one side of the wearer's mouth. The face-plate, which also carries the oxygen-breathing valves and microphone, is clamped to the rigid helmet, a gasket being interposed.

A PROBLEM FOR THE PRESIDENT

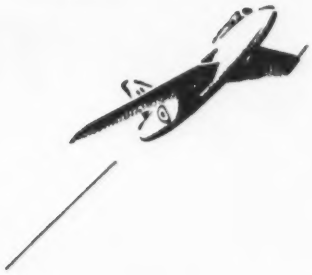
ACCORDING to the Washington correspondent of *The Times*, President Eisenhower is faced with one of the gravest decisions he has ever been called upon to make.

The orthodox Air Force view on the defence of the United States from atomic attack by Russia has been that defence as such would be impossible, as only 10 per cent or so of the attacking aircraft would be destroyed. In two years' time the Soviet Union is expected to have a sufficient stockpile of atomic bombs to cripple the U.S. at one blow, and the aircraft to deliver them will not be lacking. Air Force policy, therefore, has been—and still is—to build up a striking force of long-range bombers and bombs of such power that any potential aggressor will be deterred by their existence.

For some months now, however, a committee that includes many distinguished scientists has been studying the position, and it has now submitted its report to the President. The recommendation, in the broadest terms, is that if the U.S. sets in motion now a $16,000m three-year programme of research and development on defensive techniques, it should be possible eventually to destroy up to 95 per cent of an attacking force. A feature of the basic scheme is to locate 40 to 50 radar stations in strategic positions from Greenland to Alaska, supplementing them where necessary with ships and airborne radar. This in itself would save the warning time before a raid from the present minimum of 15 minutes to a period of four to six hours.

Additionally, a whole range of new anti-aircraft devices is envisaged. These include ground-to-air guided rockets, of which one type has already been tried out with a claimed 100 per cent success against bombers flying at 35,000ft; homing air-to-air missiles fired from piloted aircraft; and pilotless "destroyer" aircraft. It is clear that, of these three types of weapon, the first has only a limited range.

Such, then, is the alternative policy which scientists are putting forward to the President. It has its weaknesses. It might engender a Maginot Line complex, or development might be outstripped by Soviet progress. It is certainly vastly expensive, and would preclude any possibility of major tax reduction. The decision whether to initiate such an ambitious programme is likely to be only one of many that the President of the United States is destined to make.



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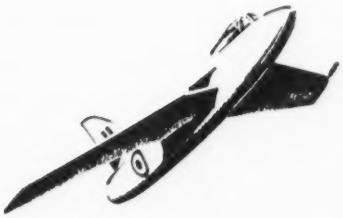

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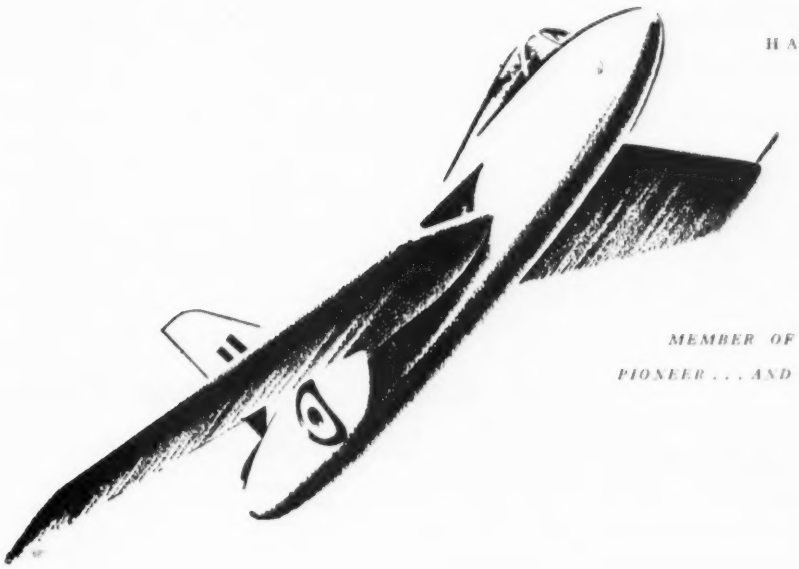

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CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

A DC-3 Replacement

WITH reference to the paragraph on the Handley-Page H.P.R.3 which appears on page 354 of the current issue of *Flight*, it would appear probable that this machine may be the projected Miles M.73 on which we in the late Miles Aircraft, Ltd., did quite a lot of design work about seven years ago.

This machine was to be powered by four Leonides engines and had a span of about 75ft. The wing consisted of a new centre section, together with Marathon outer wings. The fuselage was that of the Marathon with an additional portion inserted amidships.

There is little doubt that such a machine would fill a very useful purpose, and it is to be hoped that it may appear, albeit rather belatedly and under a new name.

We had hoped to have the prototype flying before 1950.

Farnborough, Hants. D. L. BROWN.

T.V. Film Inaccuracies

WITH regard to the film *Mare Nostrum*, in the television series *Victory at Sea*, I noticed what I believe to be an inaccuracy. The shots depicted aircraft being brought up on to a carrier's deck by lifts; unless I am mistaken these aircraft were Hawker Sea Fury fighter-bombers, and were certainly not used against the Italians, as they were not then built. The shots appeared to me to be remarkably like some newsreel photos of the Korean war.

I should be glad to know if I am correct in this assumption.

London, N.W.4. GORDON D. CONWAY.

THE recent correspondence in *Flight* on the subject of inaccuracies in the Television *Victory at Sea* series of films has prompted me to protest about a recent edition of the *Television Newsreel*, a part of which, we were told in the commentary, was devoted to the French Dassault Mystère 4. This aircraft was indeed described in this commentary, and we also were shown shots of Mystères in flight. But not only Mystères—Ouragans, too, appeared, while close-ups of the Mystère 4 on the ground were actually of an F-84G Thunderjet!

Errors in *Victory at Sea* have included, firstly, a shot of a British aircraft carrier in the Mediterranean during the war, with a folded Sea Fury on the deck, and secondly—perhaps less glaring an error—a sequence showing a U.S. Navy PBM-5 Mariner carrying the latest U.S. insignia : a film obviously taken long after the end of the war.

Leicester. SIDNEY G. CLIFFORD.

The Drift Overseas

DURING many months past you have been publishing letters on the subject of the emigration of aircraft design personnel to the North American Continent. I would hesitate to address this further letter to you were it not for the fact that your published correspondence has been of considerable influence on emigrants and is still influencing prospective emigrants.

A letter from one of your correspondents in California, published in your February 20th issue, could be misleading, I think, in some respects. There can be no more room at the top of American or Canadian design teams than there is at the top of British equivalents. It is reasonable to expect that, other things appearing equal, a local man will be appointed in preference to an immigrant to any vacancy. Sometimes various considerations will influence managements to promote the local man even if other things are obviously not quite equal. Then after all, unfortunately and shortsightedly, it is often argued that it is harder to find a good workman than a foreman. It is apparent that these difficulties must be added to the human frustrations, jealousies, and so on found in design-teams everywhere, depending largely on the quality of their leaders.

What are the considerations that influenced those who have taken the plunge? As your correspondent of February 20th remarked, a large proportion are married, with two or more children. From conversations with many of them I have formed the opinion that the main influences were the following, in order of importance:—

(1) The financial reason—years of pinching to make ends meet. The average senior member of a British design-team is a proud person. He doesn't like to discuss how much, or how little he receives for his efforts. If he has two or three growing children he may tell you, however, that he hopes to have enough left from his salary this month, after paying the bills, to buy Tommy and Joan a new pair of shoes apiece. He may speak wistfully of the 1933-model 10 h.p. car he owned before the war and now wishes he hadn't sold when petrol rationing started. A British design-staff salary, after income tax, National Health and other deductions, leaves precious little to a married man with a family after paying for food, rent/mortgage, public utilities, clothing and insurances. In North America he thinks, quite correctly at the time of writing, that these considerations can largely be forgotten if he sells himself at the right price.

(2) The travel reason—exploited with great success for years by the British Navy, Army and Air Force. The four walls of an office sometimes seem very close and the married man with children thinks that taking a job overseas may be his only chance to "see the world."

(3) The economic reason—together with his wife, he decides that the children may find more opportunities in a country with natural resources still not fully developed.

(4) The strategic reason—he thinks, rightly or wrongly, that his family may be safer in North America in the event of another "shooting war."

Britain's immediate future depends not so much on tourist attractions as on the development and maintenance of scientific and technical leadership. Some kind of "bloodless revolution" is required to give the scientist and engineer a reasonable standard of living and incentives to seek promotion. The differentials between grades should be increased, with worthwhile rewards for senior men. The Government should encourage this move by starting with its own technical and scientific servants—industry will quickly follow suit to its own advantage. The alternative, with development of air and other transport services, is that the British taxpayer will increasingly finance universities, technical colleges and the like for the benefit of overseas concerns who are his own competitors in business.

I do not feel that the urge to travel can be altogether eliminated, but it could be turned to advantage if the travellers were encouraged to return with their added experience and new ideas. Many reasons for leaving the "old country" have been elaborated in your columns; but any Briton who has lived abroad can state a good case for returning.

Montreal, Canada. PRO BONO PUBLICO.

B.A.T. Echo from Australia

AS an ardent reader of your excellent periodical from early days, I was most interested in a letter appearing in the issue of November 28th from Mr. J. M. Bruce anent B.A.T. machines.

The Bantam and Basilisk, I remember, were powered by (I think) the A.B.C. Wasp and Dragonfly respectively. My late uncle, Maj. John C. Savage, was manager for the B.A.T. Company and was also one time on the staff of *Flight*.

I had the pleasure of meeting the designer, Mr. Koolhoven, and his test pilot, Major Draper, on the occasion of the first attempt to get the little B.A.T. Gnat (?) into the air. It was powered by a vicious little horizontal-twin 40 h.p. motor, and the small suspended cockpit became detached, speeding over the rough terrain of Hendon Aerodrome. Maj. Draper closed his throttle in the nick of time.

Sydney, N.S.W. STEWART BRUNDELL.

FORTHCOMING EVENTS

Apr.	11.	British Interplanetary Society (Manchester): Conversazione and Film Show.
Apr.	15.	Institute of Transport: Brancker Memorial Lecture: "Influence of Military Aviation on Civil Air Transport," by Sir Frederick Handley Page, C.B.E.
Apr.	15.	Aircraft Recognition Society: Annual General Meeting.
Apr.	18.	British Interplanetary Society: Film Show.
Apr.	22.	R.Ae.S. Graduates' and Students' Section: "Accident Investigation," by H. Caplan, D.C.Ae., Grad.R.Ae.S.
Apr.	23.	R.Ae.S.: "Civil Jet Operations," by Capt. A. J. Majendie, M.A., A.F.R.Ae.S. (at Glasgow).
Apr. 25-26.		R.Ae.C.: Private Air Rally, Co. Wicklow.
Apr.	28.	Air League of the British Empire: Aviation Jubilee Ball, London.
May	7.	Pathfinder Association and Club: Annual Dinner.
May 9-10.		Aéro Club du Finistère Brest and Côte des Légendes Rally.
May 14-17.		American Helicopter Society: Forum, Washington.
May 14-22.		F.A.I.: 46th Annual Conference.
May	16.	Wolverhampton Aero Club: Goodyear Trophy Race and Display.
May	21.	R.Ae.S.: All-day Meeting on Aeronautical Acoustics (jointly with the Acoustics Group of the Physical Society).
May	23.	Derby Aero Club: Display.
May	25.	S.S.A.F.A.: Display, Yeadon.
May	29.	R.Aux.A.F.: Officers' Coronation Ball, London.
May	30.	Auster Flying Club: Ragosine-Auster Homing Trophy Competition.

THE INDUSTRY

Central-control Welding

A NUMBER of manufacturers in this country—including, we are informed, the Gloster Aircraft Co., Ltd.—are using the oxy-acetylene welding equipment developed by the German firm of Frama-Autogen, Frankfurt. Intended for large-scale installations, it makes use of a central constant-pressure regulator that ensures correct gas pressures and mixtures for each torch in use, independently of the ideas of individual operators.

This independent control for maximum flame efficiency is claimed to effect gas savings of as much as 10 per cent for acetylene and 30 per cent for oxygen. Also, safety is considerably increased by the fact that the gas cylinders and regulators are remote from the work-stations.

The Frama system was used before and during the war by all the major German aircraft constructors, and it has recently been installed in the Ford factory at Cologne.

The sole agency in Great Britain and Eire is held by Airco, Ltd., Eagle House, 109 Jermyn Street, London, W.1.

High-temperature Coating Alloy

THE heads of poppet valves in aircraft engines are subject to as severe a combination of stress, corrosion and high-temperature as any mechanical part. Failures are sometimes brought about either by excessive temperature or by lead oxybromide attack—particularly in modern conditions of high cylinder-pressure and leaded fuels.

During the past few years, Rolls-Royce have introduced a new valve-head coating alloy which has not only permitted valve-overhaul periods of 1,000 hours but has also greatly reduced the proportion of valves withdrawn from service during overhauls.

The new alloy is known as C.26 and its manufacturing and marketing rights have been acquired by Deloro Stellite Ltd., of Shirley, Birmingham. It has a nickel base containing chromium, aluminium, molybdenum and other minor elements. Although hard (average D.P.N. varies between 420 and 350 between 600 and 800 deg C) valves in C.26 do not become brittle and are also claimed to be free from radial cracking. It is further claimed that oxydation resistance remains excellent up to 1,250 deg C.

English Electric's Year

ADDRESSING shareholders at the annual general meeting of the English Electric Co., Ltd., held on March 19th, Sir George H. Nelson, F.C.G.I., M.I.Mech.E., M.I.E.E., the chairman and managing director, included in his speech a review of achievement with the Canberra; he also spoke of progress by the associated companies of the group, notably Napier and Marconi.

"The super-priority Canberra," he said, "although no more important to the defence and economic life of our country than our normal products, appeals to the imagination and spirit of adventure of the whole country. We are proud of all concerned in the design and production of this machine, which, as you know, made the double crossing of the Atlantic in under eight hours' flying time, and holds the Blue Riband of the air for the west to east flight in 3 hours 25 minutes, at an average speed of 606 m.p.h."

Sir George went on to congratulate A.V-M. Boyle on his new appointment as A.O.C.-in-C. Fighter Command, and spoke appreciatively of his leadership of the Canberra goodwill tour of South America. He also congratulated the crew of the Canberra which flew to Australia in 22 hours.

There had been happy relations with the other firms building Canberras in this country, with such licensees overseas as the Australian Government and the Glenn Martin Company of America, and with Rolls-Royce, Ltd., in respect of the Avon engines.

Of Napier's work in the aeronautical field, Sir George said: "The progress of development of the Nomad compound aero engine, of which the weight per h.p. is down to 1.14 lb, gives great economy in fuel, which promises well for its future success by reducing the costs of operation of air transport. We have also developed a propeller turbine engine, the Napier Eland, with a take-off power equivalent to 3,000 h.p., with an outstandingly good power/weight ratio, embodying the successful results of the company's intensive research and development of axial compressors."

The chairman had dealt in considerable detail with Marconi activities in his report at that company's general meeting earlier the same day. He had given a long list of civil and military aircraft on which Marconi equipment was used, and had said that among the airlines which had placed orders with the company were B.O.A.C., B.E.A., C.P.A., Air France and U.A.T. He had also referred to the C.A.A. trials of the Marconi V.O.R. equipment (an account of which appeared in *Flight* last week).

Finally, at the English Electric meeting, Sir George made a reference to guided-weapon activities, in these terms: "I am now able to reveal that, under pressure from the responsible Government and authorities at the time, your company entered into important commitments to design and produce guided weapons at this early stage in the creation of this new and vital defence industry. It was felt by the Government that we had research and development teams in the three essential fields, namely, in aerodynamics—with our Canberra—in the English Electric Company; in thermo-dynamics in our engine construction at Napiers; and in electronics at Marconi's. We have created a powerful design and development team and are setting up an advanced trials unit in Australia."

A "Sound" Barrier

OCCUPATIONAL dermatitis has frequently cost industry many valuable working hours, and much research has been devoted to controlling this scourge. A recent demonstration by Innoxa Laboratories, Eden Street, London, N.W.1, showed the insulating properties of their range of barrier creams, evolved after a long period of research. Two series of creams are available, namely, the BW range which is water-repellent and gives protection against acids, alkalis and other irritants soluble in water; and the BD range of water-soluble creams for protection against various specified types of irritants found in oils, paints, tars, solvents, petrols, etc.

Some most convincing experiments were carried out at the demonstration, including the removal in a few seconds of a thick deposit of tar, by immersion in warm water, and the steeping of a hand, previously cream-protected, in a solution of hydrochloric acid. It is stated by the company that the cost of protection of this kind is approximately 2½d per worker per week.

IN BRIEF

TITANINE Ltd., the aircraft-finish manufacturers, have announced a profit of £40,097 (subject to taxation amounting to £27,050) for the year ended December 31st, 1952. The annual general meeting will be held at Colindale on April 13th.

* * *

From Precision Components (Barnet), Ltd., comes a leaflet describing their "Kabi" two-, three- and four-way terminal blocks and 12-way connector strips for electrical installations. A second leaflet deals with bench-assembly trays, available in straight and curved types and two sizes.

* * *

The R.F.D. Co., Ltd., of Catteshall Lane, Godalming, Surrey, announce the appointment of Mr. C. H. Latimer-Needham, M.Sc.Eng.(Lond.), Dipl.Eng.(Lond.), F.R.Ae.S., M.S.A.E., as chief executive of their aeronautical and engineering divisions. Mr. Latimer-Needham retains his connections with Flight Refuelling, Ltd., as a consultant.

* * *

Standard Telephones and Cables, Ltd., point out that the reference to their products installed in the Viscount, as given in a list supplied by the aircraft manufacturers and printed on page 362 of our March 20th issue, was not truly representative. The correct items of radio equipment were given on page 374 of the same issue.

* * *

From Flexible Drives (Gilmans), Ltd., 195 High Street, Smethwick, Staffs, come details of their new "Flexmaster" multi-speed flexible-drive grinding and drilling machine. Duties include drilling, brushing, sanding, grinding and riffling; the machine, which has an A.C. motor, is adaptable for floor, bench or suspended mounting.

* * *

Illustrating the many protective and decorative uses of aluminium paint, the photographs in a new brochure issued by the British Aluminium Co., Ltd., Norfolk House, St. James's Square, London, S.W.1, range in variety from a picture of the Palace Pier at Brighton to one of a Handley Page Hastings. Very full information on the characteristics and use of the various grades of aluminium paste and paint is included.

* * *

In his report at the sixteenth annual general meeting of R. B. Pullin and Co., the instrument specialists, Mr. R. B. Pullin, O.B.E. (chairman), said that the company's factories at Brentford, Acton and High Wycombe were full to capacity, and that there were more orders on the books than ever before. He reported a profit of £89,265 (last year, £67,165), and said that the increased volume of work had made it necessary to seek additional capital: application had been made to the Capital Issues Committee for consent to issue a further £150,000.

Gloster Javelin

. . . a powerful weapon that will seek and
destroy any aggressor, by day and night,
in all weathers, regardless of the altitude, speed or
evasive tactics of the target. Now in super-priority
production for the R.A.F.

GLOSTER AIRCRAFT CO. LTD., Hucclecote, Glos.

MEMBER OF THE HAWKER SIDDELEY GROUP / PIONEER . . AND WORLD LEADER IN AVIATION

This A.0701 Actuator weighs 2¼ lb., moves a maximum load of 240 lb., through 3 inches at not more than 44 seconds per inch. Maximum current is 2.4 amps. at 29 volts.

LINEAR AND ROTARY ACTUATORS

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Our extensive range of linear and rotary actuators is divided into 24 and 112 volt D.C. groups. From our many years experience in designing electrical systems for the world's leading aircraft, we strongly recommend the 112 volt system as its use reduces the cable weight considerably, thereby allowing a greater pay load.

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ROTAX

BIRDS AND AIRCRAFT

THE reaction of birds to aircraft is a subject that has received but scant attention, even in this, an air-minded, bird-watching age. A good deal of research has been done into ways of minimizing the danger to aircraft from collisions with birds in flight. Such collisions are largely unavoidable. No bird intentionally allows itself to be overtaken and struck by an aeroplane; usually the speed of the machine is too great for such disaster to be avoided, and there must be many instances when the hapless bird never even sees the aircraft until the moment of impact. Such incidents are not uncommon; but the natural, uninhibited reaction of wild birds to passing aircraft is quite different, and is interesting enough for much more detailed observation than has so far been given it.

When heavier-than-air flight was in its infancy, many a rural wiseacre declared that, if these machines were to fly over the country in any numbers, then it would be a poor look-out indeed for most birds: the panic, apparently, was expected to develop into a fixed neurosis.

There is no doubt that, in general, birds were terrified of the new flying shapes that droned and buzzed overhead and among them. The first reaction was one of undiluted fear. I have been told by a naturalist of standing, who witnessed one of the earliest flying displays in England, that when the machines whirred over a nearby poultry-field the fowls rushed madly for the shelter of their house, struggling frantically with one another to get inside to what they considered would be safety. Such happenings were widespread and gave rise, not unjustifiably, to the view that man's development of flying would be inestimably harmful to bird life.

Yet, viewed against the typical reaction of most wild birds to aircraft to-day, such behaviour seems incredible. And it should be remembered that modern aircraft are larger, noisier, faster and much more numerous than they were forty years ago. To-day birds generally assume an air of indifference to almost all flying machines (with the exception of balloons, of which more anon!). They fly out of the way in a leisurely manner, occasionally wheeling round and out of the line of flight of a slow-moving plane, and often treating them with near-contempt. There is only one explanation of this phenomenon: birds in general are adaptable creatures, changing their ways as their surroundings demand.

This is borne out by the attitude which certain large and aggressive birds (chiefly predators) in unfrequented lands adopt to aircraft seen for the first time. Some of these birds made deliberate, stooping attacks on planes, much as they would in attacking other birds. Airliners crossing the Andes have been attacked by condors, many pilots have had to contend with savage attacks from eagles, whilst such relatively inoffensive birds as ravens, jackdaws, kingbirds, hobbies and even a macaw over an open-air zoo have been known to lash out at aircraft passing by. Eagles and vultures are particularly troublesome in the Near East, and R.A.F. aircraft have been attacked for many years now, in spite of both evasive and scaring action on the part of the pilots concerned. Official guidance to pilots has included the advice that a change of course is the best way of throwing off such assailants. At one time, in the India-Burma area, aircrews used to shoot at eagles in an attempt to dissuade others from coming too near. Even in Scotland golden eagles have been known to go for low-flying aeroplanes, and during the Abyssinian War an Italian fighter-pilot was struck on the head by a ferocious eagle which dived straight at him through his windscreen in spite of a machine-gun attack. A passenger aircraft flying near Allahabad was once dived-on by two eagles: one crashed headlong into an airscrew, and the other burst through one wing like a lump of rock. This attack resulted in a crash.

Such incidents show that, where aircraft are still relatively strange, birds may show hostility. In general, however, familiarity has bred, if not actual contempt, at least a wise indifference; even so, there are still a few cases in which birds are frightened of aircraft. Excellent opportunities of studying this subject, at the sanctuary grounds of the Severn Wildfowl Trust in Gloucestershire, have not been missed by Peter Scott and his colleagues. For some reason, wild geese on the flats—especially the white-fronted and barnacle species—seem unable to get used to aeroplanes overhead; it has been noticed that they take instant wing at the appearance of any aircraft within a mile and approaching at a height of less than 5,000 feet. These attacks of nerves decrease later in the season, when the flocks become larger and the birds apparently more trusting. Otherwise the immediate reaction of the geese is to rise in wild alarm and fly swiftly from the shore.

The observers on the Severn confirm my own experience in this direction, insofar as it is the actual sight of aircraft, and not their noise, which frightens birds. Probably this is part of the age-old inherent fear any large birdlike—or possibly hawklike—shape in the sky conjures up in almost all non-predator species.

Jet aircraft do not seem to worry birds at all, in spite of their terrific whine, and even the largest machine flying low in dense cloud or mist is completely ignored—just so long as it remains invisible. I remember an instance during the war, when I was photographing a nesting blackbird from a hide. On many days fighters roared overhead in close succession, at little more than hedge-top height, yet the hen blackbird turned not a feather at the din. But she heard a twig rustle under my careless foot and left her nest in a flash.

D. G.

PIASECKI DEVELOPMENTS

THE Piasecki Company has proved to be one of the most successful of the many which have entered the helicopter business in America since the war, and its progress is emphasized by the fact that all available production has, up to the present time, been absorbed by the U.S. military authorities. An important new development in the company's organization is now announced: An associated concern has been formed, known as the Piasecki International Corporation, the function of which will be to provide service, overhaul, repair and modification facilities outside the U.S.A., and also to arrange licensing for the manufacture overseas of Piasecki helicopters and spares. The board of the new company will consist of Frank Piasecki, Don Berlin, Wesley Frysztacki and Harry Pack—all directors of the parent company.

The first customers of the new régime will be the French Government, who have ordered a number of HUP-series Piaseckis for naval operations. These helicopters are six-seaters, powered by a single Continental 525 h.p. engine driving two rotors. An automatic pilot is provided, and a hydraulic winch fitted; provision is made for blade-folding to permit stowage in confined spaces.

In announcing the formation of the subsidiary corporation, Frank Piasecki points out that it may be possible to power overseas models with foreign engines; and in this connection he mentions turboprops. The significance of this remark lies in the fact that production models of the new 44-seat XH-16 transport helicopter will have Allison T-38 turboprops. The prototype, which is being fitted with 1,650 h.p. Pratt and Whitney R-2180 piston engines, is expected to fly within a few months. It will then be the first actual helicopter to conform to the "BEAline bus" specification. One particularly interesting feature of the XH-16 will be its availability in two forms, one with conventional tricycle undercarriage, the other with a "high tricycle" that gives clearance for a large detachable freight-pack under the fuselage.

DESIGNER AND HIS PRODUCTS: At 33 years of age, Frank N. Piasecki is among the youngest designer-presidents to achieve that status. The scale models give an excellent indication of the magnitude of the XH-16 project, seen—with the types of vehicle it will carry—alongside the U.S. Navy's XHUP-1.

SYMBOL OF SUCCESS: Illustrating British progress in marketing abroad the new turbine-powered airliners, the Vickers-Armstrongs Viscount appears airborne for the first time in Air France livery. This is the first of 12 Series 708s for the French airline, which has also ordered three series 1A Comets.

CIVIL AVIATION

BACK IN THE RED

DISAPPOINTING news was given on March 24th by Sir Miles Thomas, chairman of B.O.A.C., in a review of the Corporation's results over the first 10 months of the current financial year. After payment of interest, there was a deficit of £653,000, compared with a surplus of £354,000 for the corresponding period of 1951-52. Factors contributing to this setback included a £1m drop in mail revenue; the oil strike, decreasing revenue by £300,000; and the recent grounding of Stratocruisers, which cost £140,000. In terms of ton-miles available, B.O.A.C.'s output went up by 8.9 per cent—from 165m to 180m—during the period reviewed.

EAGLE'S BELGRADE SERVICE

LARGE increases are expected this summer in the number of British visitors to Yugoslavia, partly because the country is one of the less expensive European holiday centres and also because of its lately improved relations with the west. An improvement in air services between Britain and Yugoslavia is therefore likely. At present there is no direct London-Belgrade service, although the application by Eagle Aviation, Ltd., to operate one has been approved by the Minister of Civil Aviation. Eagle's plans are practically complete, and only the approval of the Yugoslav Government is awaited. During his recent visit to London the Yugoslav Foreign Minister was approached, and he promised that the matter would be given attention immediately after his return. However, it seems likely that the planned starting date of April 18th will have to be put back.

Initially, the frequency will be one service weekly, the aircraft flying to Belgrade *via* Munich on Saturday and returning the following day. Presumably Dakotas or Vikings will be used. Aviation Servicing Ltd., an associate of Eagle Aviation, recently bought fourteen 27-seat Viking IBs from B.E.A., at a reported cost of around £30,000 apiece and are said to have an option on the remaining 34 (only about six of the aircraft will actually be operated by Eagle and the remainder are being offered for sale, hire-purchase or lease). Proposed fares between London and Belgrade are those fixed by I.A.T.A.—first class, £46 11s (single) and £83 11s (return); "tourist," £37 4s (single) and £64 (return). Luxury services are operated on very few European routes nowadays, and, in fact, Eagle's preliminary announcements to travel agents have quoted only the new standard fare. The main selling point of the service will be the fact that it offers the only direct air link between the two capitals. The present B.E.A. service involves a night stop at Zurich, the second half of the journey being completed by aircraft of J.A.T. (the Yugoslav state airline).

Meanwhile, Sabena have been enterprising enough to publicize a combined air/rail service between London and the Dalmatian seaside resorts at a return fare of only about £38. Passengers are flown to Salzburg, Austria, taken *via* the Austrian Alps to the Yugoslav border by train, and complete their journey by coaches.

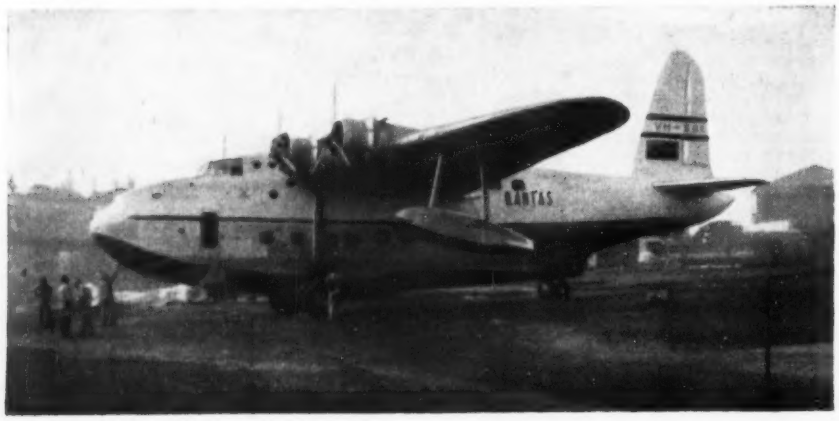
RE-EQUIPMENT OF QANTAS

WHEN he arrived in Sydney recently for a short visit, Mr. W. R. Verdon Smith, managing director of the Bristol Aeroplane Co., was reported as saying that Australia would be using both passenger and freight versions of the Britannia by 1956. He added that at least 25 Britannias should be in service by that time.

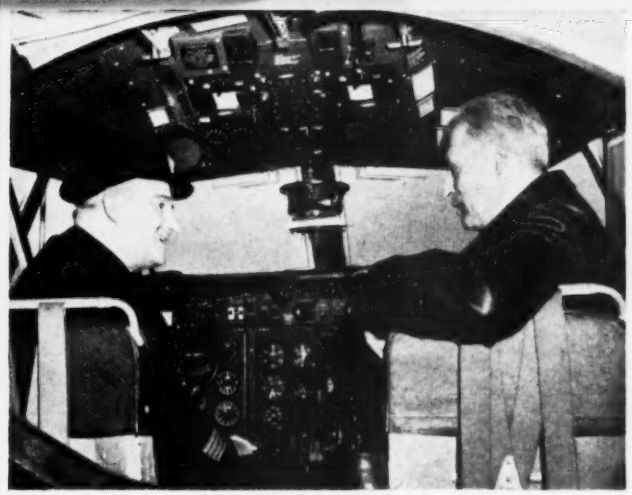
The statement recalls last December's offer by Sir Miles Thomas, chairman of B.O.A.C., to permit Qantas to take delivery of six of the Corporation's Britannias, provided that the Australian airline placed a firm order with the Bristol Aeroplane Co. Acceptance of the offer, which he described as a "gesture of friendship" to the Australian operator, would enable Qantas to introduce Britannias at least one year earlier than if they waited for completion of the full B.O.A.C. order.

No announcement of any decision regarding the B.O.A.C. proposal came until March 20th, when Mr. Hubert Anthony, Australian Minister of Civil Aviation, said that approval had been given for Qantas to give the Bristol Aeroplane Co. a letter of intent to order six Britannias "with lengthened fuselage for delivery in 1957-58." His mention of the later delivery date suggests that, in fact, Qantas have not accepted B.O.A.C.'s offer. Presumably the company regards the disadvantage of later delivery as being offset by the improved economics of a developed Britannia with higher performance and greater capacity than the first B.O.A.C. machines. As exclusively reported in *Flight* of March 6th, the Britannia series 300 will be a passenger-carrying version with 9ft 3in. more fuselage than the present series 100 prototype; the freighter version, to be known as the Britannia 200, will also have this lengthened fuselage. Whether or not this improvement will be incorporated in any of the 25 passenger-carrying Britannias now on order for B.O.A.C. has not yet been announced.

Meanwhile, Qantas have been authorized to order four more Super Constellations; three aircraft of this type are already on



IN QANTAS COLOURS appears Sandringham VH-EBX, a Mk IV formerly operated by Tasman Empire Airways. It has replaced Catalinas on the little-known runs from Port Moresby, New Guinea, to Western Papua, the Trobriand Islands, around New Britain and the Solomon chain of islands.



ELIZABETHAN'S GERMAN TOUR: One of B.E.A.'s Elizabethans—G-AMAF "Lord Howard of Effingham"—recently completed an airline sales tour of Germany, giving demonstration flights to journalists, travel agents and officials at Hamburg, Hanover, Dusseldorf, Cologne and Frankfurt. Flight Capt. C. E. F. Riley, who was in charge of the tour, is shown on the flight deck with Herr von Schiller, the Zeppelin pioneer and aviator, who made a 20-min flight from Cologne.

order, with delivery due to begin early next year. "Unfortunately," said Mr. Anthony, "it is not possible at this stage to undertake complete re-equipment with British built aircraft." The order for additional American airliners is not expected to be made at the expense of Australian currency reserves, since it is planned to sell for dollars the six earlier-model Constellations now in service.

Mr. Anthony also revealed that the airline is contemplating the use of Series 2 Comets on the Kangaroo route (between Sydney and London) towards the end of next year.

NEW AIR SERVICES APPROVED

SUBJECT to the usual conditions, the Minister of Civil Aviation has approved the following new services: Lancashire Aircraft Corporation, Ltd.: internal services until December 31st, 1959, to the Isle of Man from Blackpool and Birmingham, and to Jersey from Blackpool; East Anglian Flying Services, Ltd.: a normal scheduled service on the route Portsmouth-Shoreham-Paris for seven years; B.K.S. Aerocharter, Ltd.: internal service (initially seasonal only) between West Hartlepool and London until December 31st, 1959; Derby Aviation, Ltd.: Derby-Jersey *via* Wolverhampton until September 30th, 1959; Transair, Ltd.: an inclusive tour between London and Lourdes until October 30th, 1958.

BRITISH CIVIL-AVIATION BUDGET

THE Ministry of Civil Aviation anticipate expenditure of £11,674,000 during the year 1953-54, according to the recently published *Civil Estimates Class IX* (5) (H.M.S.O., 3s 6d). This figure represents a net decrease of £662,000 on the previous year. The Estimate makes no allowance for the proposed amalgamation of the Ministries of Transport and Civil Aviation.

The main categories of expenditure are given below; figures in parentheses represent the previous year's totals:—

Salaries, £4,175,000 (£3,982,000); travelling and incidental expenses, £225,000 (£225,000); Air Transport Advisory Council, £8,000 (£3,000); non-technical supplies and transportation, £620,000 (£585,000).

Equipment and Ancillary Services.—Capital expenditure, £367,000 (£375,000); current expenditure, £782,000 (£795,000); civil aircraft and associated equipment, £100,000 (£150,000).

Works, Buildings and Lands.—Capital expenditure, £4,415,000 (£3,770,000); current expenditure, £1,315,000 (£1,310,000).

Ground Services for Commonwealth and Other Routes.—Grants and other expenses of a capital nature, £366,000 (£375,000); grants and other payments for current expenses, £734,000 (£620,000); meteorological services, £203,000 (£210,000).

Grants to Airways Corporations and Associations.—B.E.A., £750,000 (£1,000,000); associates of the Corporations, £110,000 (£20,000); B.O.A.C., nil (£1,000,000).

Other Items.—Various aviation services: grants and other expenses, £105,000 (£77,000); catering services, £19,000 (£15,500); I.C.A.O.; grant in aid, £105,000 (£82,000), conference, £22,000 (nil); overseas telephone and telegraph services, £67,000 (£51,000); grants to flying and gliding clubs, £40,000 (£16,500); miscellaneous expenses, £41,000 (£68,000).

From a gross total for the year 1953-54 is deducted £2,895,000 for appropriations in aid to give the net figure.

In a detailed breakdown of the Departmental economy, some interesting references are made to airport developments under the heading—"Works, Buildings, and Lands." In each case the three figures quoted refer to, respectively, the vote required for 1953-54, the sums voted in 1952-53, and the amounts required for completion of work:—

Blackbushe, £50,000, nil, £42,000; Edinburgh, £30,000, nil, £15,000; Gatwick, £10,000, £10,000, £4,990,000; Hurn, £2,000, £2,300, nil; London, £2,890,000, £2,009,600, £4,964,000; Prestwick, £21,000, £41,500, £40,000; Renfrew, £100,000, £60,000, £97,500; Rhoose, £51,500, £40,000, £23,500; Eastleigh, £12,000, £10,500, £2,400; Stansted, £3,500, £49,600, nil.

L.A.P. PASSENGER TERMINAL

CONSTRUCTION of the three-storey passenger handling building on the south-east face of the central terminal area at London Airport has just begun. The building, which will be of steel with brick cladding, will take about two and a half years to complete. Taylor Woodrow, who built the tunnel connecting the terminal area with the Bath road and are also constructing the new control tower, are the constructors. Mr. F. Gibberd F.R.I.B.A., M.T.P.I., is the architect, and the structural engineers are Sir William Halcrow and Partners.

A FAIR LINK

AS in previous years, Olley Air Service, Ltd., propose to operate a daily service between the London and Birmingham sections of the 1953 British Industries Fair, which is being held between April 27th and May 8th. Aircraft will operate between Croydon and Castle Bromwich, the latter being only a hundred yards from the main entrance to the Birmingham fair. Consuls and Rapides will be employed. Return fare will be £5 18s, the same as last year, and the flight will last approximately one hour in each direction.

CONSTELLATIONS AT NUTTS CORNER

NORMALLY nothing larger than B.E.A. Vikings land at Nutts Corner, near Belfast, although during the war heavily loaded Liberators of Coastal Command used to operate from there. On March 15th, however, a B.O.A.C. Constellation was diverted to the airfield owing to bad weather at Shannon. The aircraft landed uneventfully, and took off again later in the day.

Another B.O.A.C. Constellation called at the airport on March 22nd to pick up the Queen's University Rugby team from Belfast, who are now on tour in America.

FASTER COMET TIMES

SUMMER schedules are being introduced this month along the various Comet routes. Flying times have had to be adjusted because of seasonal changes in weather conditions, and will, in certain cases, be slightly longer than recently. However, after more than 10,000 hours of Comet experience on the routes, it has proved possible to streamline the ground organization and permit shorter transit stops. In most cases, such stops are to be reduced from one hour to 40 minutes. These savings result in appreciable shortening of the journey times on all but one of the various routes. Between London and Singapore reductions of from 1 hr 50 min to 6 hr 10 min are being effected. Savings on the London-Johannesburg route are 20 minutes on the outward run, and 45 minutes on the return journey.

CONVERTS to the use of air-freight are Charles H. Pugh, Ltd., makers of ATCO lawn-mowers, who describe such services as "efficient and economical over relatively short journeys." Here is a recent consignment going aboard a B.E.A. Dakota for Belfast; a similar load went to Dublin by an Aer Lingus Wayfarer a few days earlier.

BREVITIES

AIRLINE transactions at the I.A.T.A. Clearing House in London during January totalled £6,168,700 compared with £5,607,000 in the first month of 1952.

* * *

The correct method of assembling Rumbold safety belts type M.192 and M.368 is described and illustrated in the A.R.B.'S *Notice to Licensed Aircraft Engineers and to Owners of Civil Aircraft (No.* 41, *Issue* 1).

* * *

K.L.M. have introduced cheaper fares on their DC-6B service between Amsterdam and Mexico City—the only direct route from Europe. Second-class passengers, who pay £68 15s less than the luxury fare, travel in a separate cabin.

* * *

Switzerland's first concrete runway—the 6,000ft single strip at Contrin, Geneva—is to be extended by 1,300ft. Another projected improvement at this Swiss terminal is the construction of a new airport restaurant.

* * *

Capt. H. V. Worrall, manager of Lancashire Aircraft Corporation at Yeadon Airport, is to retire in April. Capt. Worrall, who has 11,000 flying hours to his credit, will join a Leeds advertising firm.

* * *

Qantas Empire Airways were the only airline to exhibit at the recent Ideal Home Exhibition. The company's stand showed a section of the interior of an aircraft and a full-size replica of a Constellation galley, in which preparation of pre-frozen meals was demonstrated.

* * *

It is believed that Capt. J. Hazzard of A.N.A. is, at the age of 39, the youngest pilot to have reached the total of 20,000 flying hours. Capt. Hazzard, who has been a pilot for 22 years, is the nephew of Capt. K. Virtue, also of A.N.A., who holds the Australian record of 21,700 hours.

* * *

Traffic statistics for Kingsford Smith Airport, Sydney, during the calendar year 1952 show that on average 2,300 passengers arrived at or departed from the airport each day. Thirteen airlines —six domestic and seven overseas—operated 113 services daily from Kingsford Smith at an average load factor of 67.9 per cent.

* * *

The average daily total of 155 tons of manufactured goods lifted from Berlin to Hamburg by British operators is being increased by about 20 per cent. Seaboard and Western Airlines recently contracted with the Berlin Senate to carry 220 tons weekly between Berlin and Hamburg; the first flight, by a DC-4, was made on March 10.

* * *

The Institute of Transport announces that the 1953 Brancker Memorial Lecture, arranged for February 9th and postponed because of the illness of the lecturer, Sir Frederick Handley Page, will now take place at 5.45 p.m. on Wednesday, April 15th, in the Jarvis Hall, 66 Portland Place, London, W.1. Sir Frederick will speak on *The Influence of Military Aviation on Civil Air Transport*. The meeting will be open to visitors.

"Flight" photograph

MAINSTAY: Like so many medium-sized airlines, Malayan Airways depends largely on the DC-3; the company operates a fleet of 11, plus two Rapides, on its domestic and international service. One of the DC-3s is pictured taking-off from Kuala Lumpur, which is connected to Singapore by some 40 return services weekly.

Western Airlines have ordered three DC-6Bs for delivery in the summer of 1954.

* * *

Finnair (Aero O/Y) has now taken delivery of its first Convair 340. Two more are on order.

* * *

Temporarily recalled for duty nearer home following the recent floods, the Dutch weather ship manning Ocean Station Alpha (350 miles east of Greenland) has been replaced by an American vessel.

* * *

As from March 5th Alitalia began operating its Rome-Malta-Tripoli twice weekly service with DC-4s. Previously the company had worked this route with a DC-3 chartered from L.A.I. Alitalia plans to operate the service with Convair CV 340s in about two months' time.

* * *

Believed to be the largest single consignment of TV equipment to be exported by air from England, over 3,000 lb of teleciné and studio lighting equipment was taken to Caracas recently by a K.L.M. Skymaster. Manufactured by Marconi's Wireless Telegraph Co. Ltd, the equipment was needed for the opening of a new "televisa station" in the Venezuelan capital

* * *

Capt. O. P. Jones, who flies B.O.A.C. Stratacruisers on the North Atlantic route, recently completed his 4,000,000th mile of flying; he is probably the first British Pilot to reach this total. Since 1917 Capt. Jones has flown some 20,540 hr. in 100 types of aircraft and has carried 131,479 passengers.

* * *

B.E.A. carried over 75,000 passengers last November, 31 per cent more than in the corresponding month of 1951. Over the same period associate services carried 3,000 passengers, an increase of 91 per cent (accounted for largely by the "Safari" services to East Africa). B.O.A.C. carried 23,000 passengers during the five-week period ended, compared with 17,000 in the calendar month of November, 1951 (B.O.A.C.'s operations are now calculated on a weekly basis).

DUNSTABLE DINNER

THOUGH formed in 1933, the London Gliding Club is now in its twenty-third year. This baffling historical fact was disclosed, but not explained, by Mr. Dan Smith, chairman and C.F.I. of the club, at the annual dinner, held at the Dunstable clubhouse on Saturday, March 21st.

Mr. Smith went on to speak of the club's most important asset —the friendliness and goodwill of its members—and to forecast, for the future, far more cross-country flights. Winching up to more than 1,500ft was now available, and if one couldn't get to Cornwall from that height—well, the winching height would have to be raised further. Surveying the club's achievements, the chairman pointed out that, in addition to giving the present world champion his basic training in gliding, it had—through its members—helped in forming other gliding groups in many parts of the world.

Proposing the toast of "The Guests," Mr. Dudley Hiscoa (formerly club chairman) first mentioned the world champion Mr. Philip Wills and the world champion tailplane-retrieving wife, Mrs. Kitty Wills. Also present he continued were Mr. Tipper, the captain of the neighbouring golf club ("we try not to land on their golf course, but we do replace divots") and Mrs. Tipper and Mr. and Mrs. Kay, whose farm adjoined the club's ground.

Replying on behalf of the guests, Mr. Philip Wills told a "Little Red Riding Hood" story—with a Dunstable emphasis—and congratulated the club on its site, clubhouse and aircraft. One of the most attractive things about gliding was its unexpectedness, he continued, for—as Dan Smith had just pointed out to him—who would have thought one year ago that he (the speaker) would soon be able to paint the initials of "World Champion" on his door? Mr. Wills went on to emphasize that the red tape which tended to throttle other branches of aviation was not present in gliding. All should endeavour, he concluded, to keep things that way.

Bouquets were then presented to Mrs. Betty Smith, wife of the chairman, by Mr. Geoffrey Stephenson on behalf of the club's flying committee; and to Mrs. Turvey, responsible for the clubhouse catering, by Mr. Smith on behalf of the club. The final speech consisted of some brief remarks by Mr. Tipper, of the Dunstable Golf Club; "We don't really mind you knocking our wires down," he affirmed, and in fact gliding proficiency must be improving, for fewer such occurrences were now taking place.

The dance which followed gained much atmosphere from the music of the excellent quartet present—the fact that two of the club's flying members belong also to one of London's better dance orchestras being no coincidence. Dancing continued until midnight.

Landscapes in Oils (2)

From Alfwin to Esso

BY BERNARD HOLLOWOOD

ON this second leg of our expedition into Esso land we approached our target from Oxford and came in low (the springs of our ancient roadster responding poorly under severe pressure from artist, writer and guide) along A34. The portals of Milton Hill stood open and welcoming and we swept majestically enough into a fine drive, lapped the front lawn and pulled up smartly in an odour of burning rubber before

"*Time somebody invented Esso. . . .*"

the elegant Ionic pillars of the manor house.

It would be easy to continue in this vein, so why not? The guide-books tell us that Esso House, formerly the Manor of Milton Hill, is steeped in nine centuries of history. There was this King of Wessex and one Alfwin, but why the king gave Alfwin fifteen hides of land and why Alfwin in turn conveyed them to Abingdon Abbey are facts shrouded for ever (to us) in mystery. It sufficeth to say (that's what Esso House does to one's literary style) that the present solid, mellow, lovely, ivy-clad walls were built on the site of the manor by one Thomas Bowles of Abingdon in the latter part of the eighteenth century, that extensive alterations were made in the 1840's by Sir Gilbert Scott, and that after many vicissitudes of fortune and ownership the property passed into the beneficent care of Esso in 1939.

Once, this ancient demesne was occupied by the flower of English nobility, but in 1798 Pitt invented income-tax and gradually, very gradually, the faces at the windows changed. To-day, the mansion and the score of

modern buildings on the estate are occupied by chemists, physicists and technicians, by men and women in white coats and the prime of life. Hundreds of them.

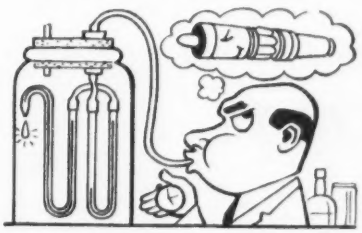
What are they doing? Yes, a reasonable-enough question. "What," we asked one man, who seemed to be smoking a sort of hookah—a rubber-tube affair connected to an enormous glass jar full of "U" tubes and rods and wires and other quaint scraps of equipment—"are you doing?"

After a time he pressed a stop-watch, took the tube from his mouth and began to discourse rapidly about oil. "The viscosity index," he said, "is a measure of an oil's viscosity-temperature characteristics and is expressed as a number . . . . The viscosities in Saybolt Universal seconds at 100° F. and 210° F. are determined . . . V.I. may be obtained by the formula V.I. = L–U over L–H times 100. . . ."

Baffled, we retreated into badinage.

"It all sounds simple enough," we said.

"Ah," said the scientist (and I *think*



he took us seriously), "but it's the calculations that take the time."

In other labs. we saw fuels and lubricants under minute inspection and analysis, under microscopes, spectrophotometers, chronometers, hydrometers, calorimeters, viscometers, evaporometers, mobilometers, pycnometers . . . meters galore, even thermometers. And we were suitably impressed.

The experts work in four main groups. The two research teams (Lubes and Fuels) concoct new juices, keep the whole range of Esso products at top quality, and contrive and develop new uses for them. But the manufacture of new lubricants and fuels — from the chemist's flask to the refinery—is a long job calling for testing and re-testing at every stage: and this is where the other two groups come in. One, which we will call the engineering outfit, is responsible for the large-scale laboratory preparation of the products and their

testing in engines, while the other team operates after the manner of our scientific friend mentioned above. It makes sure that the products behave well in a chemical sort of way. This, very roughly, is the picture and the scope of the division of labour at Abingdon, though all the teams work hand-in-glove, and in the closest collaboration with the aircraft and motor industries. And with the Ministries.

Indefatigable research is all very well for trained researchers; but after several hours of sightseeing these visitors were so obviously defatigable that they were led away to recuperate in the Esso social club, a very handsome building which boasts (in all seriousness) the largest thatched roof in the world. We made a number of oblique references to this thatch and the learned scientific domes of those it shelters, and one expert, a chemist, had the decency to register mild amusement.

When Esso House and shades of Alfwin had been left behind, and the bewildering mass of equipment and multiplicity of dials (worse than any flight deck) had become a hopeless blur in the memory, the writer and the artist compared notes. They decided (a) it would be trite to mention the incalculable benefits which every industry in Britain derives from the researchers of Abingdon, and (b) that the neatest way to conclude the article would be to repeat the simple understatement —

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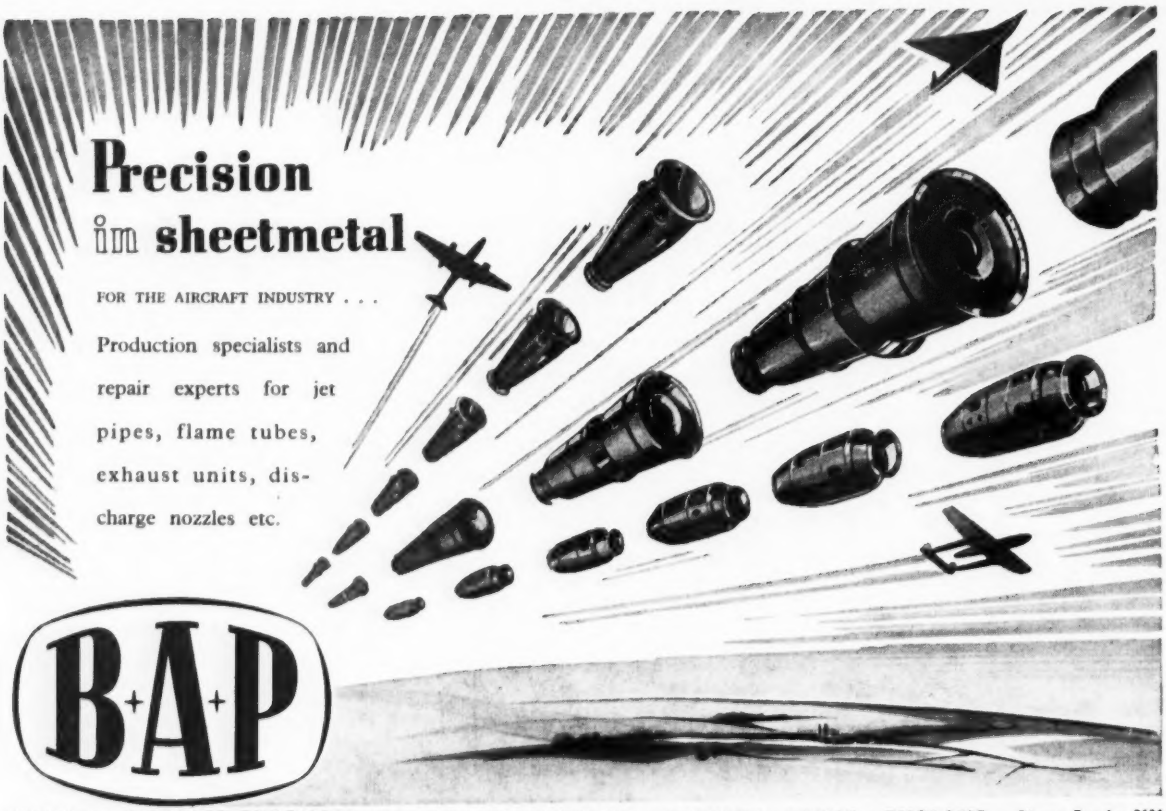

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SERVICE AVIATION

Royal Air Force and Naval Aviation News

New C.O. for Queen's Squadron

ON Sunday, March 22nd, S/L. P. J. Anson formally handed over the command of No. 603 (City of Edinburgh) Squadron, R.Aux.A.F., of which Her Majesty the Queen is the Honorary Air Commodore, to S/L. R. Lloyd Davies. A squadron parade was held, during which S/L. Anson said goodbye to the unit, symbolizing the change of command by handing the squadron badge to the new commanding officer.

S/L. Lloyd-Davies is no stranger to the Royal Auxiliary Air Force. For the past two years he has been training officer to No. 600 (City of London) Squadron, whose Honorary Air Commodore is Queen Elizabeth the Queen Mother. S/L. Anson has been posted to Church Fenton, where he will be O.C. Flying.

Duke of Edinburgh in Germany

HIS ROYAL HIGHNESS the Duke of Edinburgh arrived at Bückeburg airfield on the evening of March 17th for a five-day tour of Service units in Germany. He had flown from London Airport in a Viking of the Queen's Flight and was accorded a three-Services guard of honour, 250 strong. On his inspection of the guard he was accompanied by W/C. A. M. Taylor, station commander, R.A.F. Bückeburg, and Lt.-Col. R. Hodson, commander of the guard. The Duke wore the uniform of an Admiral of the Fleet, and after being received by the Chiefs of the three Services in Germany (General Sir Richard Gale, Rear-Admiral R. St. V. Sherbrooke, and Air Chief Marshal Sir Robert Foster) he took the salute.

On the 19th the Duke flew by helicopter from Costedt to Wunstorf to watch a flying display, and on that occasion wore the uniform of Marshal of the Royal Air Force for the first time on his tour. His next call was at Celle (photograph above), where he watched a flying display and chatted with the wives and families of R.A.F. personnel.

On March 20th His Royal Highness had hoped to tour the R.A.F. units in Germany by helicopter, but was prevented from doing so by a heavy haze, which further caused cancellation of a flying display at Gütersloh. Instead, he visited the reconnaissance wing at Gütersloh, inspected photographs, and watched the R.A.F. Regiment tackle a battle course. Earlier he had arrived at Bad Oeynhausen by helicopter to inspect the Headquarters of the Northern Army Group, and after visiting the R.A.F. units he flew to Krefeld.

The Duke's helicopter flights were the first to be made by a member of the Royal Family in such an aircraft. Special consideration was given in advance before the decision was taken to use a helicopter for his use. For increased comfort one of Westland's own S-51s was specially prepared for the occasion, repainted with Service markings, and handed over on a loan agreement. The pilot was S/L. W. R. Gellatly, who is normally stationed at Boscombe Down for helicopter test and experimental flying. The S-51 was specially upholstered and a new Alvis Leonides engine and a new rotor head had recently been fitted. Special radio was installed.

M.E.A.F. Exercise

A THREE-DAY exercise—known as "Session"—began on March 26th in the Suez Canal Zone, to test air defences in the area. All R.A.F. Meteor and Vampire fighter squadrons in the Zone took part as defending forces, while other M.E.A.F. squadrons acted as the attackers, operating from bases in Libya, Cyprus and Jordan. Varsities from Flying Training Command in Britain were despatched to Cyprus for the exercise, and Venoms and Meteors from the Central Fighter Establishment went to the Canal Zone.

French Cadets at Cranwell

ELEVEN officers and 30 cadets of the French Ecole de l'Air, with their Commandant. Colonel de Maricourt, arrived on March 19th at the R.A.F. College, Cranwell. During the morning they saw a parade of R.A.F. cadets and toured the College; later they visited Lincoln and in the evening, having returned to the College, were guests at a cocktail party. The following morning a flying display was followed by the R.A.F. College inter-squadron Ferris drill competition, which was judged by Royal Marine officers, and in the afternoon the College XV played the Ecole de l'Air XV at Rugby. A fencing match between the French and R.A.F. cadets took place in the evening.

Mr. W. Acomb, who accompanied the visiting cadets, was formerly Librarian at the R.A.F. College and is now Professor of English at the Ecole de l'Air.

DUAL INSPECTION: S/L. Anson (right) and S/L. Lloyd-Davies, the old and new commanding officers respectively, inspect No. 603 (City of Edinburgh) Squadron, R.Aux.A.F., during the recent change-of-command ceremony.

BOX OF TRICKS: H.R.H. the Duke of Edinburgh, in the uniform of Marshal of the Royal Air Force, appears to find points of interest in the nose oleo of a Belgian Thunderjet. The occasion was the Duke's recent visit to R.A.F. Station Celle, referred to on this page.

"Eagle" at Vigo

THE 36,800-ton aircraft carrier H.M.S. *Eagle*, which has been on a five-day courtesy visit to Vigo, Spain, took a Spanish military mission out to sea on March 20th to watch flying exercises. The city of Vigo had, on the previous night, entertained *Eagle's* Commanding Officer, Rear-Admiral John Hughes-Hallett, and other officers of the carrier and of the escorting destroyer, *St. James*, to a gala dinner.

No. 30 Transport Unit Replaced

THE famous No. 30 Transport Unit of the Royal Australian Air Force, which has partnered No. 77 (Fighter) Squadron in Korea for nearly three years, has been replaced by No. 36 Transport Squadron, from Australia. The Dakotas operated by No. 30, together with most of the squadron personnel, have been absorbed into No. 36. Mr. William McMahon, the Australian Minister for Air, has said, "No. 30 Transport Unit's record in the Korean war has been outstanding. Its name disappears from the R.A.A.F.'s line of battle, but it will not be forgotten."

During its Korean service No. 30 maintained a transport service between No. 91 (Composite) Wing in Japan and No. 77 Squadron and the British Commonwealth Division in Korea.

Fighting Cocks Association

THE Officer Commanding No. 43 Squadron is keen to get the Fighting Cocks Association on its feet again. During the past few months it has become increasingly difficult to keep in touch with members,

SERVICE AVIATION . . .

mainly due to the lack of an up-to-date address list, and the loss of some correspondence. All ex-members of the squadron are asked to contact F/O. J. A. Hughes at R.A.F. Leuchars, Fife. The Association was formed to foster and maintain comradeship between those who served, and those who are serving, in 43 Squadron. It is hoped to hold a reunion in July or August, and the bi-annual newsletter is in course of preparation.

The R.A.F. Marathons

THE first of 30 Handley Page Marathons, which will soon be serving with the R.A.F. as navigation trainers, should by this time have arrived at the Royal Aircraft Establishment, Farnborough, for clearance of its navigational equipment. Flying qualities were proved in the Service trials last year. These followed the airworthiness trials of the civil version and limited airline service in Africa and the Antipodes, prior to the recent delivery of Marathons to West African Airways Corporation and Union of Burma Airways for regular service on tropical routes.

The equipment of the R.A.F. Marathons includes Rebecca Mk 4, Gee, and radio compasses. Located amidships, for ground and astro. observations, are pear-drop windows and an astrodrome. Two pupil navigators sit at their plotting tables in sturdy, rearward-facing seats, and with them is a staff crew of pilot, navigator and signaller. From the United Kingdom the Marathons will fly as far afield as the Mediterranean. Their maximum range is 1,400 miles.

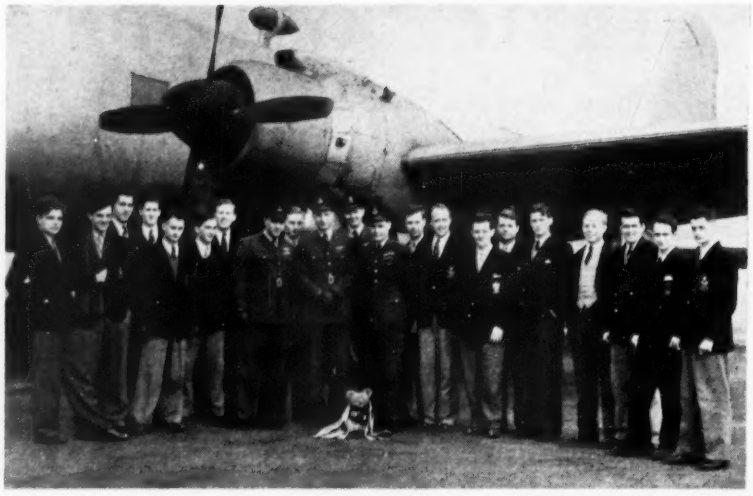
R.N.Z.A.F. Display

FROM a reader in New Zealand comes a note on "Air Force Day," held on February 28th at R.N.Z.A.F. Station, Whenuapui. The station is the home of No. 41 Transport Squadron, so Hastings and Bristol Freighters were much in evidence; one of the former aircraft—actually the one that is to compete in the London-Christchurch Race—gave an individual demonstration.

The display opened with a fly-past by two Catalinas, six Freighters, the Hastings, a Harvard, and four Mustangs. Individual demonstrations which followed included contributions by the Harvard and an Eon Olympia sailplane, and the Mustang quartette gave an aerobatic display which, however, lacked the excitement that the crowd of 15,000 expected.

In the set-piece, the Mustangs "softened-up" a ground target, upon which Hastings and Freighter aircraft dropped paratroops, and then, on a second run, supplies. The loads sent down by the Freighters included scout cars, jeeps, a 25 lb. howitzer, and reinforcement troops. The ground forces did their best to resist this assault, but were eventually neutralized with the aid of the Mustangs. It was a noisy and satisfying affair that was to have been the concluding item, but a T.E.A.L. Solent unexpectedly appeared and made several fly-overs, on one of which it seemed to be on the point of making a runway landing.

There was an excellent static show, and it was felt that the only thing lacking during the day was the presence of R.N.Z.A.F. Vampires, which many of the spectators had hoped to see.



TEAMWORK: In December, 1950, the log book of the first Valetta of No. 622 Squadron, R.Aux.A.F., was handed to S/L. R. H. McIntosh, D.F.C., A.F.C., by Mr. Aiden Crawley, then Under-Secretary for Air. On March 21st, twenty-one members of the Oxford and Cambridge Universities Air Squadrons' rugger team (seen with aircrew and mascot at Blackbushe) were flown in a 622 Squadron Valetta to Germany to play against 2nd T.A.F. and other teams.

Pathfinder Dinner

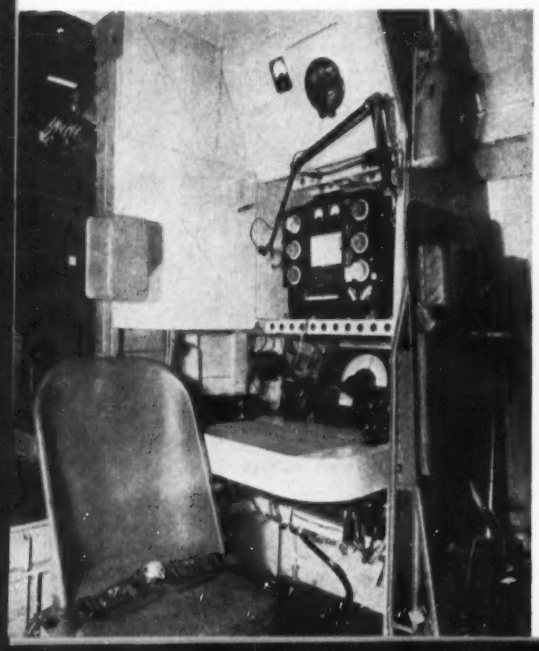
THE annual dinner of the Pathfinder Association will be held at the Dorchester Hotel, London, on Thursday, May 7th, at 7.30 p.m. It is expected that some members of the Air Council, the High Commissioner for Australia and past and present Command chiefs of the R.A.F. will attend.

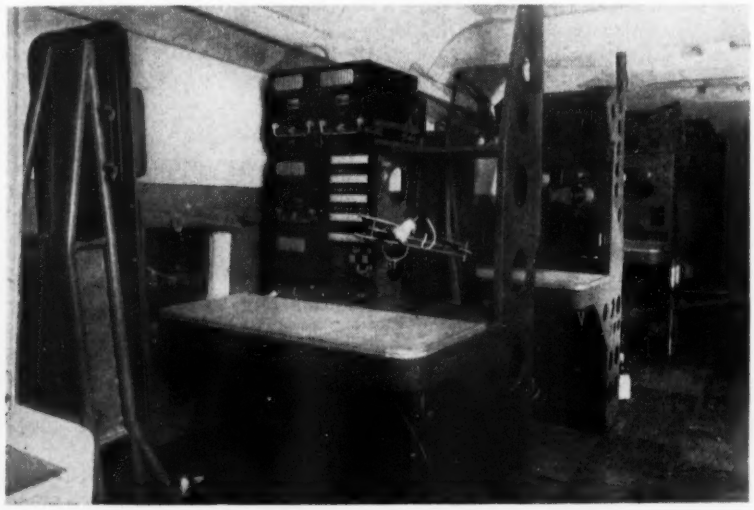
Reunions

The fifth all-ranks reunion of No. 78 Squadron 1939-46 will be held on Saturday May 9th, at the Albert Tavern, 52, Victoria Street, London, S.W.1. Tickets, 8s 6d, from F. Ivers, 23, Carnaby Street, London, S.W.1.

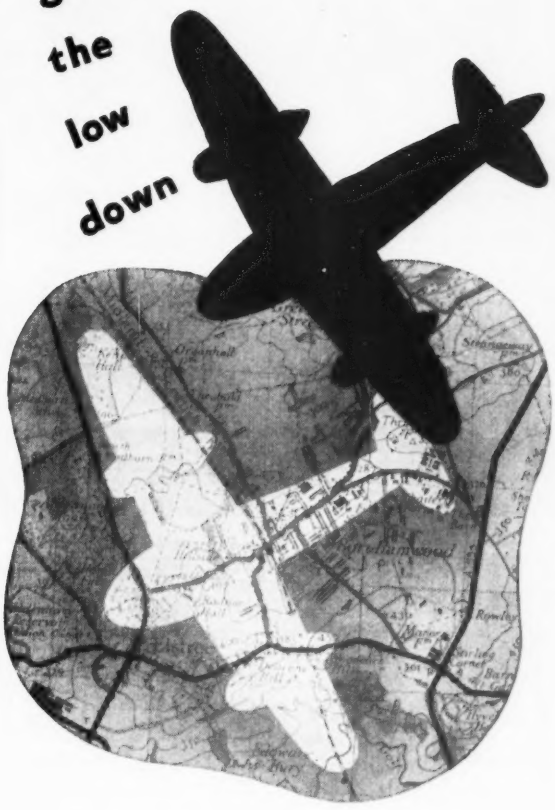
The sixth annual general meeting and re-union dinner of No. 2 Group Officers' Association will be held on May 9th. A special welcome is extended to W.A.A.F. and W.R.A.F. officers. Particulars from S/L. J. A. Beattie, 6, Leamington Road Villas, London, W.11.

ACADEMIC INTERIOR: The left-hand view below shows the radio operator's position on the Handley Page Marathon navigational trainer, a note on which appears above. The cockpit is ahead. Right, the navigator-instructor's position (nearest camera) and positions for two trainees.





Going up to get the low down



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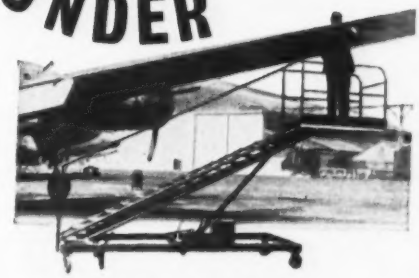

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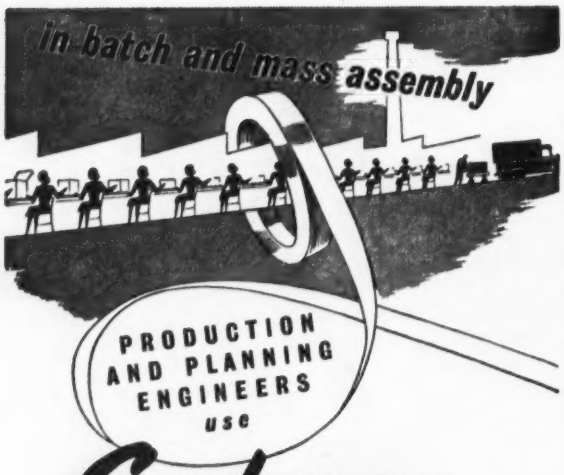

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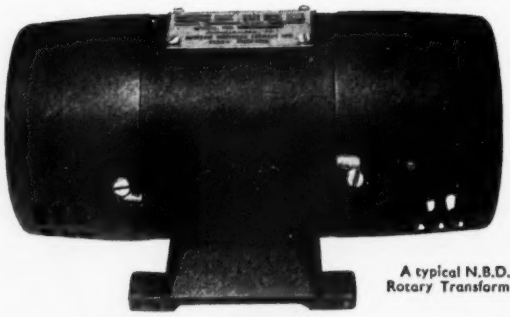

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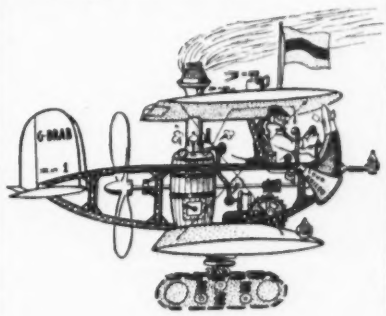

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THE proprietor of British Patent No. 616814, entitled "Hinge Structure," offers same for licence or otherwise to ensure practical working in Great Britain.—Inquiries to Singer, Stern and Carlberg, 14, East Jackson Boulevard, Chicago, 4, Illinois, U.S.A. [9417

PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned application to operate a Scheduled Air Service:—

APPLICATION No. 182. From Airlines (Jersey) Ltd., of 4, The Parade, St. Helier, Jersey, Channel Islands, for permission to operate certain of their frequencies on their normal scheduled service on the Manchester, Coventry, Bournemouth, Guernsey, Jersey, Dinard, Rennes and La Baule route (Application No. 41), recently approved by the Minister of Civil Aviation, between Coventry, Bournemouth and Guernsey/Jersey only.

THIS application will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on July 30th, 1952. Any representations or objections with regard to this application must be made in writing stating the reasons and must reach the council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 9, Buckingham Gate, London, S.W.1, from whom further details of the application may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of the route in question, their application, if not already submitted to the Council, must reach them within the period allowed for the making of representations or objections.

THE Council also give notice that the following application has now been withdrawn:—

APPLICATION No. 81. From Airwork, Ltd., of 15, Chesterfield Street, London, W.1, for a Colonial Coach service between London (Blackbushe) and Dar es Salaam, with Viking aircraft, which was advertised in "The Times," "The Aeroplane," and "Flight" on October 24th, 1952. [9444

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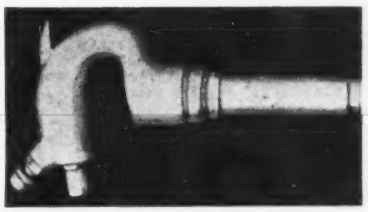

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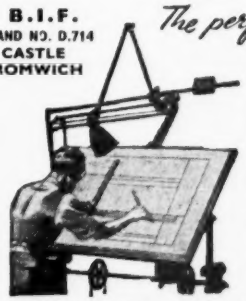

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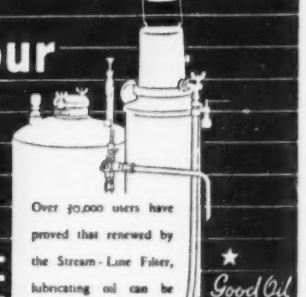

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